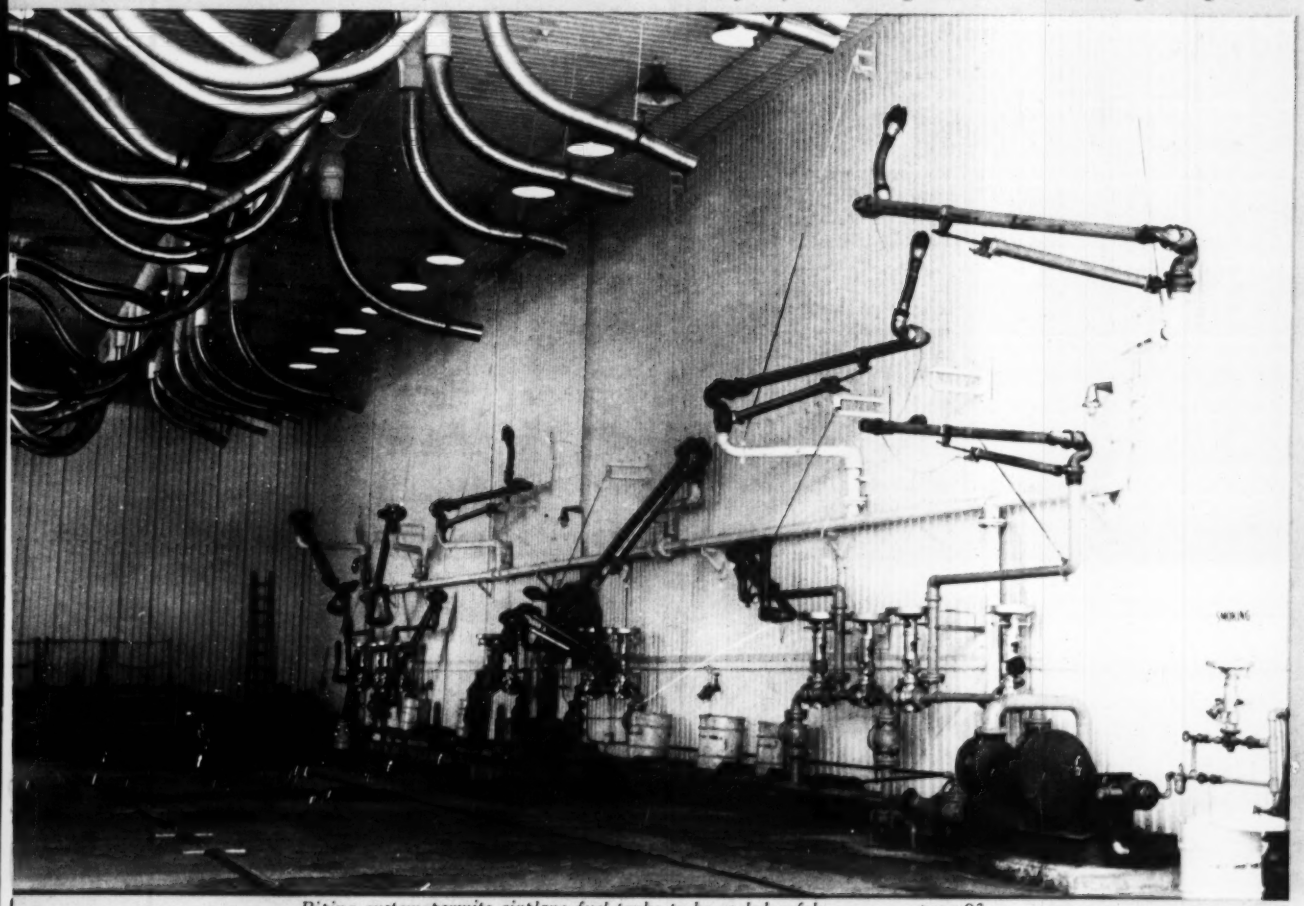
Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

NOVEMBER ★ 1953

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 135—Journal Section of The American Society of Heating and Ventilating Engineers



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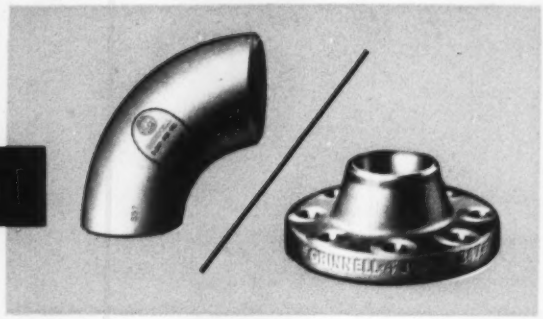
for trouble-free service



GRINNELL

STAINLESS STEEL WELDING FITTINGS and FLANGES

To help combat mounting costs in the installation and maintenance of piping systems where corrosive or certain other service conditions are involved, Grinnell offers a comprehensive range of welding fittings and flanges in stainless steel.

- **To prevent corrosive attack.**
- **To obtain adequate impact resistance at low temperatures and sufficient creep strength at high temperatures.**
- **To provide sanitary conditions.**
- **To avoid contaminating the product.**

Grinnell welding fittings and flanges are available in types 304, 347 and 316. These are in the chromium-nickel grades known as "18-8". The corrosion resistant properties of stainless steels are primarily due to the chromium content which ranges from 17% to 20%. The addition of nickel in ranges from 7% to 14% improves the corrosion resistance as well as the properties at elevated temperatures. A molybdenum addition of 2% to 3%, as found in type 316, increases the resistance to sulphurous and phosphoric acids, brine and hypochlorite solutions, and improves the general resistance to other corrosive liquids, as well as improving the physical properties at elevated temperatures. A columbium addition of approximately 0.4% to 1.0%, as found in type 347, creates non-susceptibility to carbide precipitation which can cause intergranular corrosion.

In addition to stainless steel, Grinnell offers welding fittings and flanges in carbon steel, nickel, Inconel, Monel, aluminum and brass.

Write for new booklet giving complete data on Grinnell stainless steel welding fittings and flanges. No obligation.

stainless steel welding fittings
Types 304, 347, 316

DESCRIPTION	SCHEDULE†	PIPE SIZE, IN.‡
90° Long Radius Elbow 45° Long Radius Elbow 180° Long Radius Return Straight Tee	5s, 10s, 40s, 80s	½ to 12
Reducing Tee	5s, 10s, 40s, 80s	¾ to 12
Cross (Straight and Reducing)	5s, 10s, 40s, 80s	1¼ to 12
Concentric Reducer Eccentric Reducer	5s, 10s, 40s, 80s	¾ to 12
Lateral (Straight or Reducing)	5s, 10s, 40s, 80s	1 to 12
Cap	5s, 10s, 40s, 80s	½ to 12
Lap Joint Stub End-Long	10s, 40s, 80s	½ to 12
Lap Joint Stub End-Short	5s, 10s, 40s,	½ to 12

† *5s is Featherweight, 10s Lightweight, 40s Standard, 80s Extra Strong.*
‡ *Larger sizes available on special order.*

stainless steel flanges

150 lb. and 300 lb. Steel Flange Standard *(Higher series available on application).*

DESCRIPTION	PIPE SIZE, IN.
Welding Neck Slip-on Lap Joint Threaded Socket Type Blind	½ to 24

150 lb. Corrosion Resistant Standard. *(For use with schedule 10s and 5s pipe. Rated at 150 psi at 500°F, 225 psi at 150°F, when used with full-faced gaskets).*

DESCRIPTION	PIPE SIZE, IN.
Buttwelding Slip-on Blind	½ to 12

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WHENEVER PIPING IS INVOLVED

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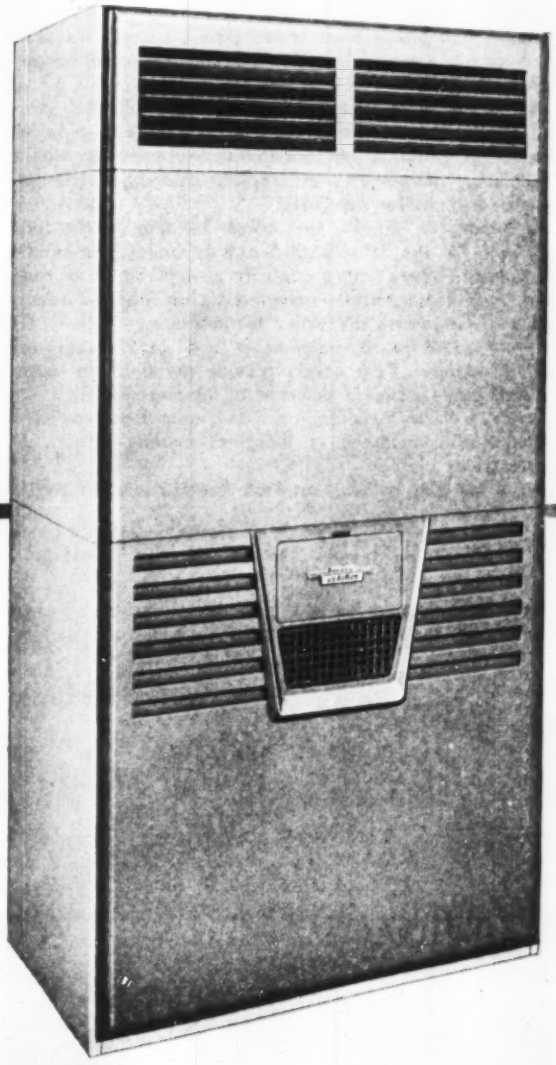
pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

usAIRco NEW PACKAGED AIR CONDITIONER

Remarkably flexible!



Now . . . usAIRco designs a packaged air conditioner with a choice of air intake or discharge panels as standard equipment . . . to fit the field requirements of any installation. Compressor, blower and plenum sections can be ordered separately. These features give you a store conditioner or home unit from the same components. Available in 5 sizes, 2 through 10 hp.

Completely Restyled and Re-engineered!

3 component sections: compressor, blower, plenum.

Central control panel.

New airfoil louver discharge grille.

Free and open air intake, easy to keep clean.

Plenum chamber with side louvers available.

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- ▶ Vertical mounted coil; horizontal air flow.
- ▶ Single filter section handles both fresh and recirculated air.
- ▶ Heat coil can be mounted inside blower cabinet (if necessary).
- ▶ Manual-reset hi-pressure cut-out.
- ▶ New spring mounting insures vibrationless compressor operation.
- ▶ Simplified blower motor mount.

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Export: 13 E. 40th St., N. Y. 16, N. Y.

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CENTRAL STATION UNIT

DUCT GAS HEATER

HOME UNIT

MODU-AIRE

SEE OUR COMPLETE LINE IN SPACE 504

Bush heating installation...a pipe"

Bush FINNED pipe, that is! . . . at new Remington Rand Building in Hartford, Conn.

Contractors praise Bush finned pipe . . . say it's easiest to install of any type of finned radiation. Expansion hangers are the answer.

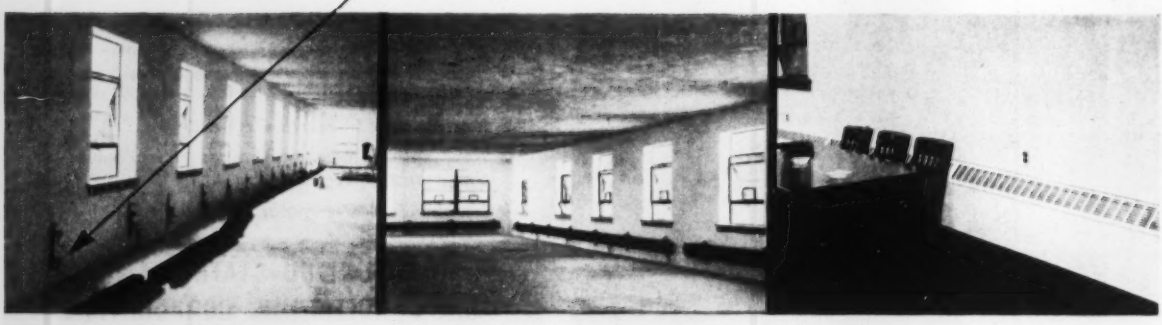
Bush expansion hangers . . . simple, efficient, practical. Attached to the wall with 2 bolts, these adjustable pipe hangers provide for a full 3" of horizontal expansion as well as 2" of pitching. Moreover, the complete assembly is designed to serve as support for the cover.

At Remington Rand's new office building in Hartford, the heat load for the 72' x 128' two story building is handled by two boilers — each with a capacity of 4480 sq. ft. of radiation. Continuous flow control — actuated by an indoor-outdoor thermometer — regulates the water temperature.

Bush type W finned radiation (4" x 4" on 2" pipe) has been used throughout. Bush covers provide the finishing touch to a modern, easily installed commercial heating system.

Check with a Bush Engineer the next time you're on an institutional, commercial or industrial heating job . . . make your task a "pipe".

Write for free bulletins on Bush finned radiation and covers.



Architect: Frederick C. Taleb; Hartford, Conn.
Contractor: Morris A. Norberg Co.; Hartford, Conn.
Engineers: Horley and Capocefalo; Winstead, Conn.

BUSH MANUFACTURING COMPANY
WEST HARTFORD 10, CONNECTICUT

Heating Piping & Air Conditioning

Vol. 25 No. 11

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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NOVEMBER 1953

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YOURS FREE!

Farr Company Offers a Competent Staff of Field Engineers Plus Laboratory Services to Assist You with Your Air Filtration Problems

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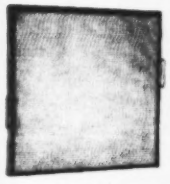

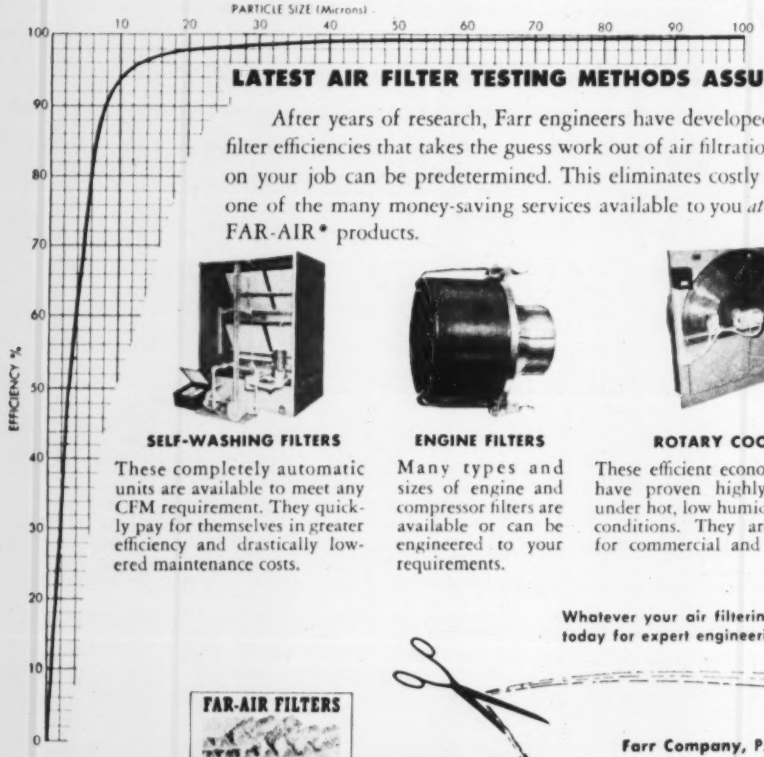

LATEST AIR FILTER TESTING METHODS ASSURE YOU OF PEAK PERFORMANCE

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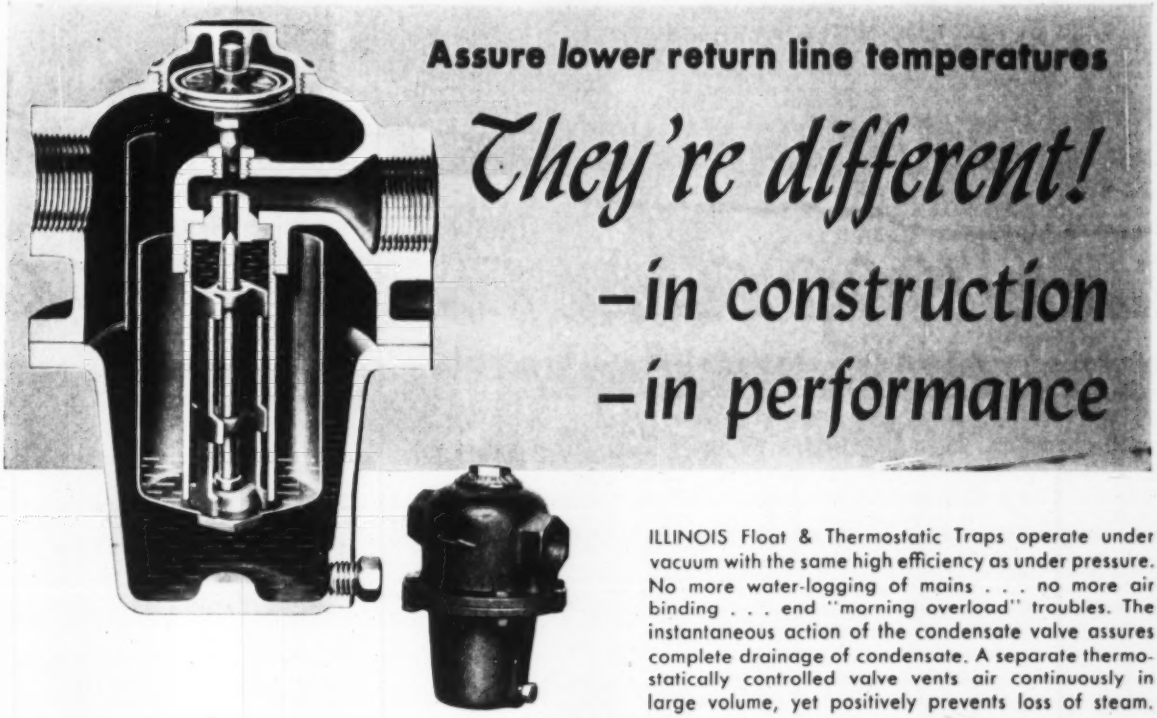
ILLINOIS
Float & Thermostatic TRAPS



ILLINOIS Float & Thermostatic Traps operate under vacuum with the same high efficiency as under pressure. No more water-logging of mains . . . no more air binding . . . end "morning overload" troubles. The instantaneous action of the condensate valve assures complete drainage of condensate. A separate thermostatically controlled valve vents air continuously in large volume, yet positively prevents loss of steam.

Recommended Applications

Low Pressure Heating Systems, Ventilating Units, Unit Heaters, Pre-Heaters, Re-Heaters, and other Fan System Heat Surface, Large Radiators or Pipe Coils, Hot Water Generators, Drips of Mains and Risers. Draining Coffee Urns, Warming Tables, Pasteurizers, Vacuum Pans, Heat Exchangers, Process Heaters, Sterilizers, Autoclaves, Cooking Kettles, Kilns and similar equipment.

(For operating ranges from 25 inches vacuum to 15 pounds pressure use Series G Traps. For pressures up to 50 pounds use Series MG.)

Rated capacities of various size traps from 200 pounds to 5000 pounds condensate per hour, at 2 pounds differential across the trap.

Positive, Instantaneous Valve Action . . . an Exclusive Feature

The Snap Action of the Condensate Control Valve assures efficient trap operation. The valve is not directly attached to float but is actuated by impact of the dropping float. Valve action is instantaneous whether the trap is handling its maximum capacity or only a trickle of condensate and regardless of variation in pressures. The valve is either wide open or tight shut—never cracked on seat, never hanging in an intermediate position. It is water-sealed at all times. It cannot chatter and is never affected by pulsations in the flow of condensate to the trap.

Simple, Compact, Trouble-proof

No ball floats to puncture or collapse—no toggles, pins, levers or hinges to corrode, stick or bend. Hard, stainless alloy steel renewable valves and seats are used for both condensate and air bypass units. Both valve units are at the top of trap out of dirt and sludge, assuring long life and satisfactory operation without attention. Straight through connections save head room, fittings, trenching, labor, and avoid low hung piping or lifts. Trap is easily opened for inspection without disturbing piping.

TRAP NOT DAMAGED BY FREEZING. Freezing will not harm this trap in any way and it is self-thawing.

Write for Bulletin 34-C

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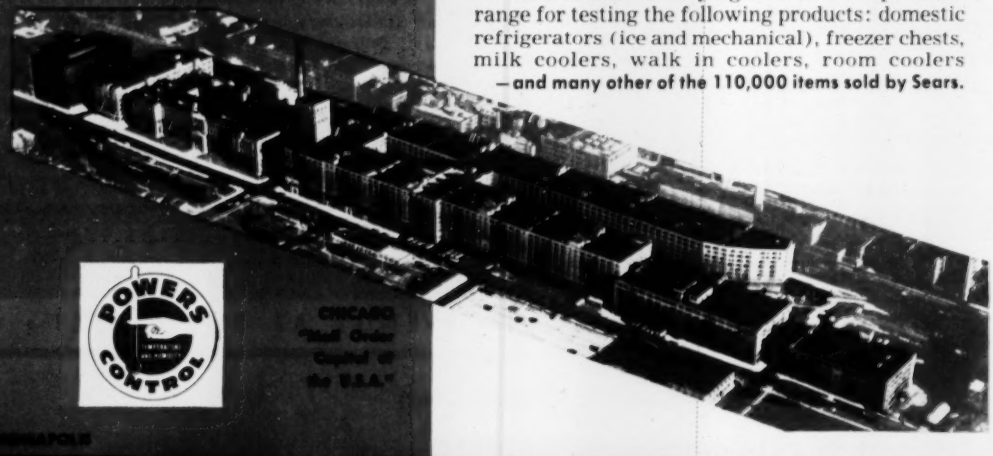

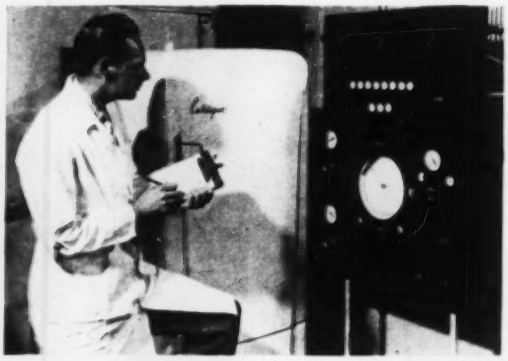

SEARS "COLDSPOT" REFRIGERATORS

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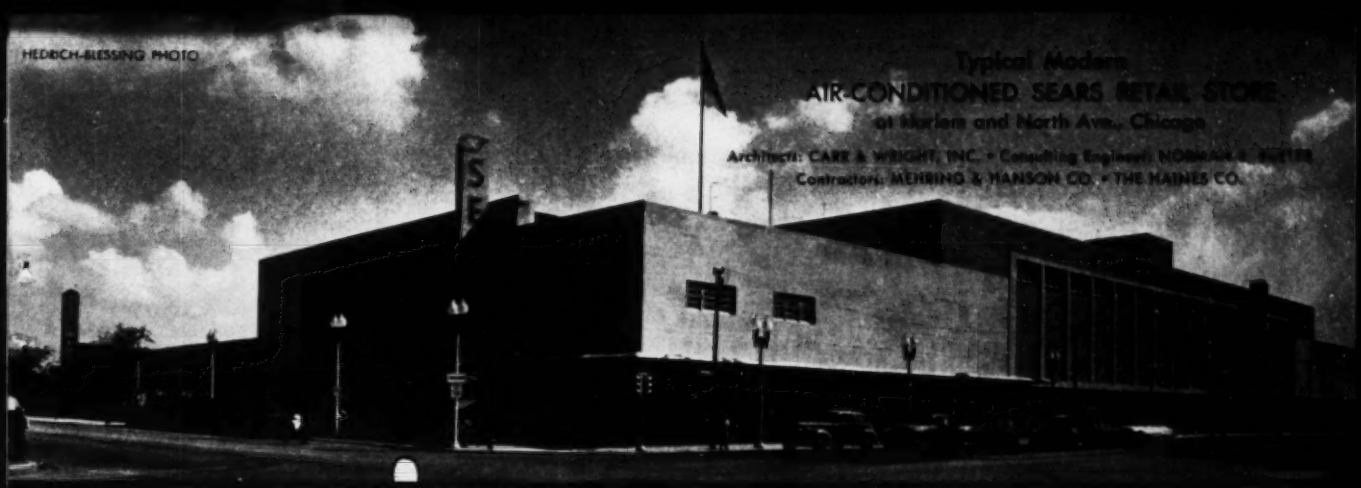
Regulated by POWERS Controls

"Satisfaction or Your Money Back"— Sears famous guarantee, is one of the reasons for their phenomenal growth and success. They were one of the first to establish testing laboratories to carefully check merchandise.

Photo above shows one of 4 Powers Temperature and Humidity control panels regulating 4 air conditioned rooms of varying size and temperature range for testing the following products: domestic refrigerators (ice and mechanical), freezer chests, milk coolers, walk in coolers, room coolers —**and many other of the 110,000 items sold by Sears.**

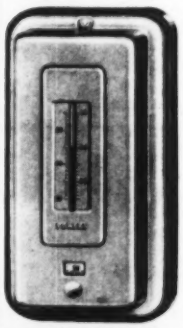

HEDRICH-BLESSING PHOTO
Typical Modern
AIR-CONDITIONED SEARS RETAIL STORE
at Harlem and North Ave., Chicago
Architects: CARE & WRIGHT, INC. • Consulting Engineers: NORMAN & KEITER
Contractors: MEHRING & HANSON CO. • THE HAINES CO.

This and Over 50 Other SEARS Stores from Coast to Coast are POWERS Controlled

has used

POWERS PNEUMATIC *Control Systems*

In Many of its Prominent Buildings



Powers Room Type Thermostat pneumatically regulates heating and air conditioning systems. Outstanding for accuracy and dependability.

After 40 to 47 Years of Service in Sears Chicago Administration and Merchandise buildings, Powers pneumatic systems of temperature control are still in operation.

Fuel savings and greater comfort obtained here by the prevention of OVER-heating have paid a profitable return on the investment in Powers control. With today's higher fuel costs savings are larger than ever before.

When you select a temperature control system, consider Powers. Users report lower maintenance cost and 30 to 50 years of dependable service.

THE POWERS REGULATOR CO.

Skokie, Ill. • Offices in Over 50 Cities in the U.S.A., Canada and Mexico

OVER 60 YEARS OF AUTOMATIC TEMPERATURE CONTROL

(b42)

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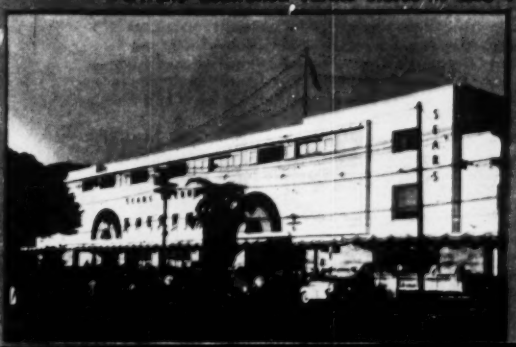
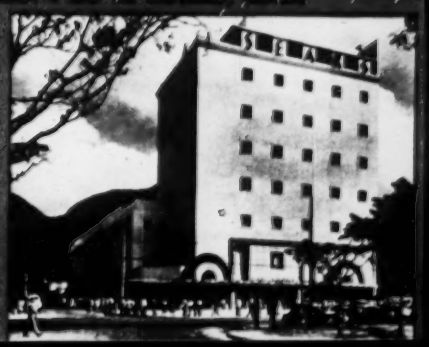
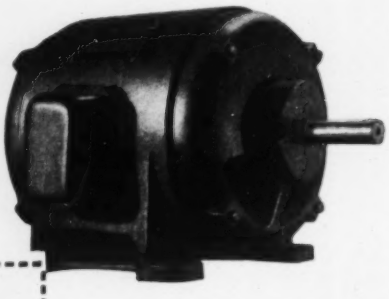


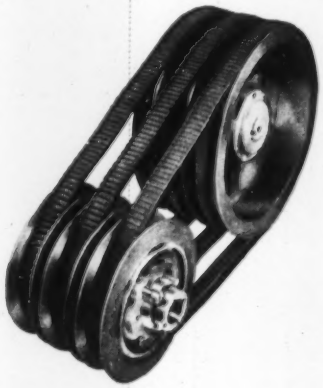


If Your Problem IS HERE

Between Power

ALLIS-CHALMERS





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Milwaukee 1, Wisconsin

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- ☐ Motors — Bulletin 52B6052
- ☐ Control — Bulletin 14B7132
- ☐ *Texrope* V-belt Drives — Bulletin 20B6051

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Company .....

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A-3904

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Sizes from ½ hp up. Types include single and multi-speed squirrel-cage, dc, wound-rotor and synchronous. Enclosures include drip-proof, splash-proof, totally-enclosed, non-ventilated, totally-enclosed fan-cooled and explosion-proof. Totally-enclosed and explosion-proof motors built in famous finned design which greatly reduces cleaning problems and costs, or in the tube-cooled design which gives the same maintenance savings in the larger sizes.

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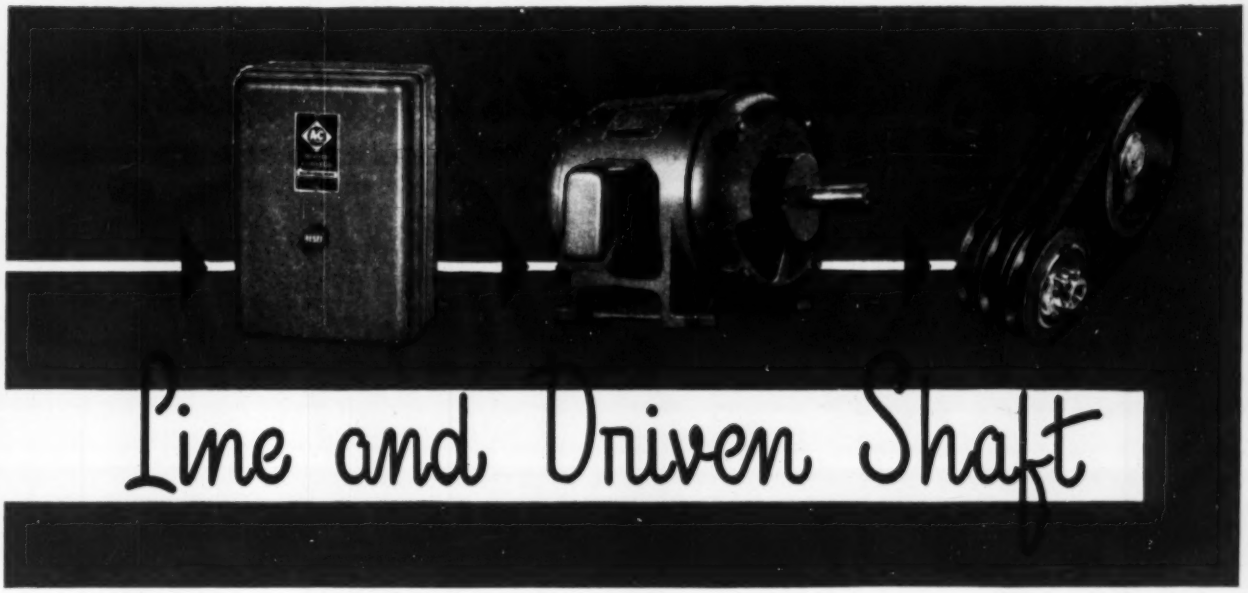
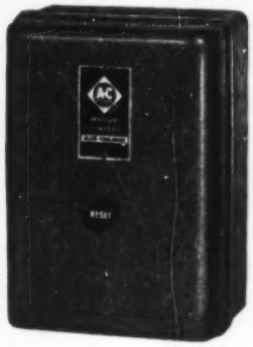
Constant speed sheaves include *Texsteel* sheaves and *Magic-Grip* easy mounting sheaves in a complete range of sizes.



Line and Driven Shaft

CAN HELP YOU



Control — There is an Allis-Chalmers control to meet every requirement of motor operation through the complete range of motor sizes. Manual and magnetic, reversing and non-reversing, across-the-line and reduced voltage starters are included. Push button and pilot devices are available in any number of positions and in all combinations. Accessory Allis-Chalmers control equipment includes dc contactors, timing relays, contactors for heavy duty starting and rotary control switches.

YOU CAN SAVE TIME, SAVE WORK, SAVE MONEY and be sure of your fan, pump and compressor drives when you use coordinated components from Allis-Chalmers. For Allis-Chalmers can supply you with control, motor and *Texrope* V-belt drive for your machine . . . all of integrated design and manufacture.

Unit Responsibility

By using Allis-Chalmers coordinated drive components, you save paperwork and the time and cost of matching parts from different sources. More important, you know the components will fit together properly . . . that assembly will be completed quickly and easily.

And you don't have to worry about passing the buck on service. Allis-Chalmers stands behind the complete drive and takes responsibility for the proper functioning of every part.

Delivery from Stock

Immediate delivery from stock can be had on nearly all standard items from warehouses and distributor stocks located all over the country.

Allis-Chalmers representatives are experienced in air conditioning problems and can give you the kind of help you need in selecting the best drive for your machine. And this team of field experts is backed up by a large factory engineering staff.

Certified Service

Allis-Chalmers continues to serve you after the sale with nearly a hundred Certified Service Shops located in every industrial area in the country. Allis-Chalmers Certified Service Shops are carefully selected independent service shops that use only factory-approved parts and methods in complete servicing of Allis-Chalmers equipment.

Texrope, Texsteel, Magic-Grip, Vari-Pitch, and Super-7 are Allis-Chalmers trademarks.

ALLIS-CHALMERS

IMPORTANT MESSAGE

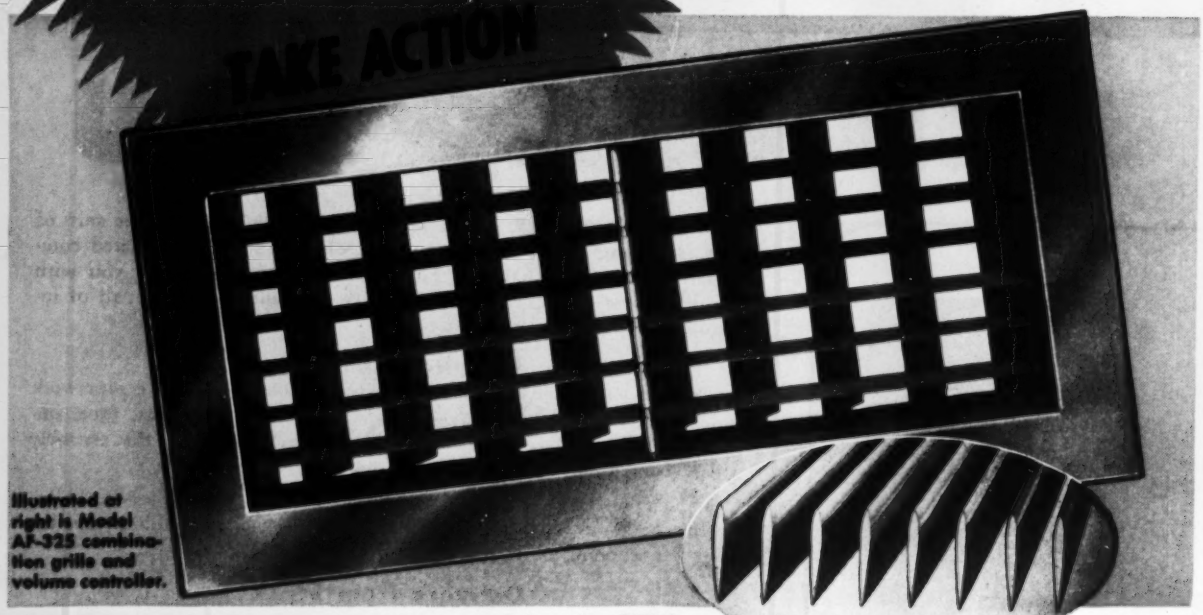
To everyone responsible for the specification and installation of air conditioning outlets.

IF YOU ARE GETTING LESS THAN EVERY SINGLE ONE OF THESE FEATURES IN EVERY OUTLET YOU USE...YOU ARE NOT GETTING YOUR MONEY'S WORTH.

..See for Yourself

COMPARE

TAKE ACTION



Illustrated at right is Model AF-325 combination grille and volume controller.

These important comparison facts explain why TITUS AIRFOIL OUTLETS look better, perform better, are better constructed, *OUTMODE* all other outlets.

They are built above and *beyond* average demand, yet cost is kept at standard prices.

Illustrated above cutaway view showing solid section, streamlined Airfoil Louvers.

❶ 75% TO 85% FREE AREA . . . .

Greater than ordinary grilles.

❷ EASY 4-WAY ADJUSTMENT . .

Not necessary to remove or invert grille to get complete 4-way adjustment.

❸ INSTALLS IN 1/10 ORDINARY TIME . . . . . .

Workmen need not remove grilles. Dirty hands never touch grille or wall to leave dirty, expensive smudges.

ORDER *A Sample* TITUS GRILLE

IT FEATURE FOR FEATURE WITH EVERY OTHER GRILLE ON THE MARKET TODAY

4 SOLID SECTION AIRFOIL LOUVERS.....
Smooth as glass. Streamlined. Eliminate turbulence. Control air properly.

5 ONE-PIECE FRAME..... Adds new beauty to any installation. No unsightly corner cracks or corner patches.

6 EXTRA STRENGTH..... Without clumsy bulk. Easy to carry. Easy to handle.

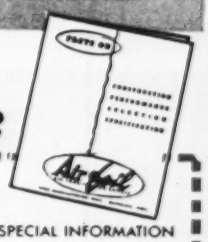
7 CLEAN WITHOUT REMOVING GRILLE...
Removable core not necessary Made available, however, if desired.

8 LOW NOISE LEVEL..... Streamlined louvers handle air with near perfect performance. Hold noise level to absolute minimum.

Before you start your next job, order a sample grille. Prove to yourself by *True* comparison . . . holding the grille in your hands . . . that you get better grille construction, more beauty, and consequent better grille performance from TITUS OUTLETS. ORDER TODAY.

***SALES OFFICES IN ALL PRINCIPAL CITIES**

FREE 1953 CATALOG



MAIL COUPON NOW

TITUS MANUFACTURING CORP.,
WATERLOO, IOWA

CHECK TYPE OF GRILLE ON WHICH SPECIAL INFORMATION IS DESIRED.

- ☐ Air Conditioning outlets
- ☐ Return air grilles and registers
- ☐ Volume controllers
- ☐ Door ventilators
- ☐ Special made-to-order grilles
- ☐ Send complete New 1953 Catalog

NAME _____

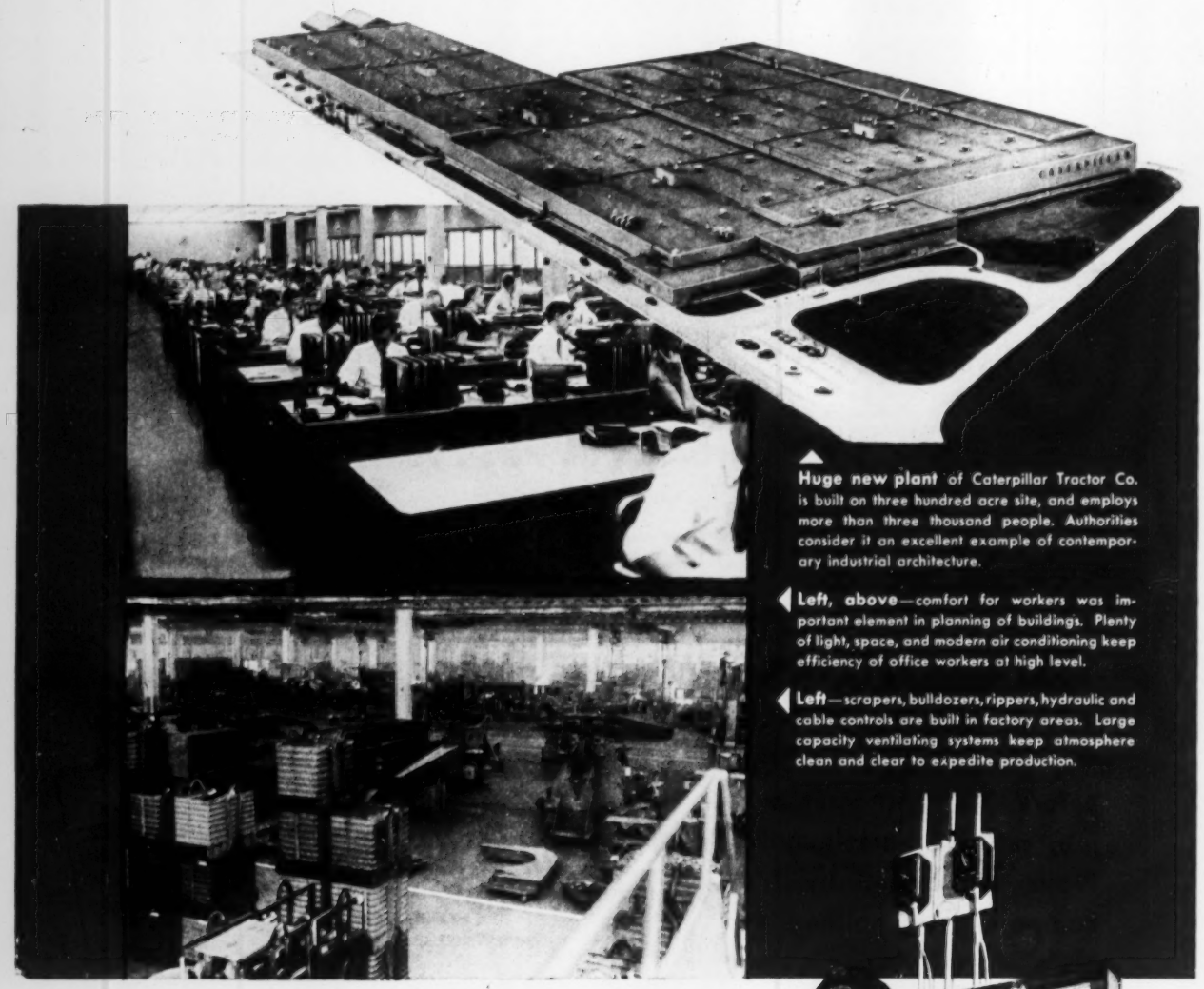
ADDRESS _____

CITY _____ STATE _____

BARBER COLMAN

ELECTRIC Control Center

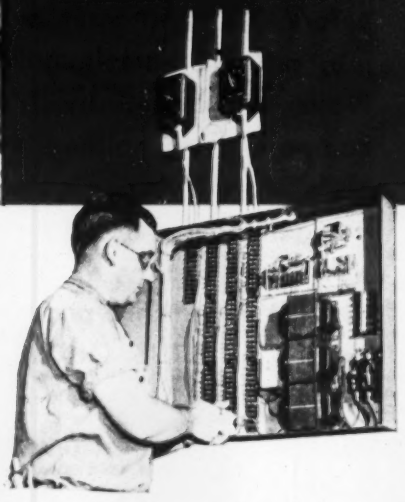
Modern, accurate, flexible electric control systems regulate heating, ventilating, air conditioning in new Joliet plant of Caterpillar Tractor Co.



Huge new plant of Caterpillar Tractor Co. is built on three hundred acre site, and employs more than three thousand people. Authorities consider it an excellent example of contemporary industrial architecture.

Left, above—comfort for workers was important element in planning of buildings. Plenty of light, space, and modern air conditioning keep efficiency of office workers at high level.

Left—scrapers, bulldozers, rippers, hydraulic and cable controls are built in factory areas. Large capacity ventilating systems keep atmosphere clean and clear to expedite production.



Simplified installation *results from Barber-Colman technique of employing a "Control Center" with prewired accessories—switches, relays, transformers, resistors, etc.—and numbered terminal strips for connecting all components of each electric control system. Each unitary system can be checked or revised at "Control Center" cabinet.*

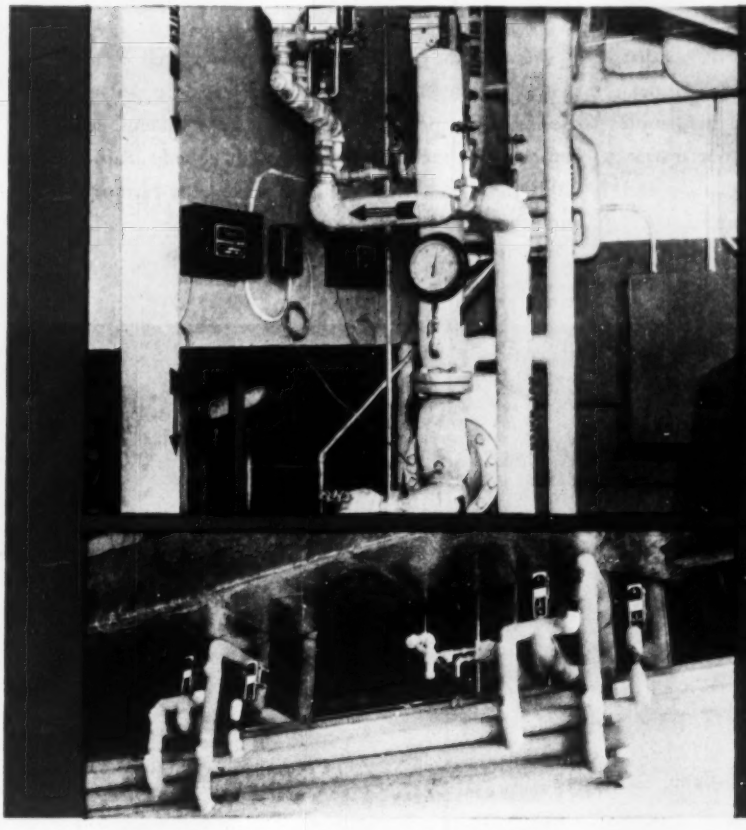
Keeping pace with the completion of the building program of Caterpillar Tractor Co. in Joliet, Illinois are Barber-Colman unitary temperature control systems, each with its own electric "Control Center."

Starting with building "A" and "B" in 1950, continuing through extensions to building "B" and new building "C" in 1953, there are now 63 independent "Control Centers" operating heating, ventilating, and air conditioning systems throughout the plant. General offices, first aid rooms, and the shop office, auditorium, cafeteria, and metallurgical laboratory are air conditioned. As a safety precaution, the office temperature control system is interlocked with the autocall and fire alarm systems. In an emergency, a warning signal is given, all exhaust fans stop, and all air intake dampers are closed.

Over 1,500,000 cfm are handled by the 59 ventilating units in the factory area. Each has its own "Control Center," operating independently of the others. Should trouble develop in one area, there is no need for a complete plant shutdown. Three boilers, two of 80,000 lbs., and one of 100,000 lbs. per hour capacity, furnish steam for heating and processing. Electrical consumption per month is now over 3,000,000 kw.

For the complete story on how electric "Control Centers" can modernize your temperature control systems . . . and bring you substantial savings in time and materials . . . phone nearby Field Office or send coupon today.

Building "A" and "B": Giffels, Vallet & L. Rossetti, Detroit, architects and engineers. Building "B" extension: Lyle V. DeWitt, Decatur, architect; E. O. Hull, Peoria, engineer. Building "C": Crenshaw & Jost, Pekin, architects, Caterpillar Engineering Dept., engineers. For all buildings: Stanley-Carter Co., Detroit, heating contractor; Gould Electric Co., Chicago, electrical contractor for temperature controls installation.



Left—in keeping with modern design of plant, Caterpillar ordered the finest of electric control equipment. For example, all motor-operated valves have oil-submerged operators.

Below—space is saved by installing an individual "Control Center" cabinet in the web of a column in each control area.

Left—battery of motor-operated valves with oil-submerged operators in building "C," controlling heating and cooling operations.

BARBER COLMAN

ELECTRIC
Control Center

Automatic Controls • Air Distribution Products • Industrial Instruments
Aircraft Controls • Small Motors • OVERdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

BARBER-COLMAN COMPANY, ROCKFORD, ILL., U. S. A.
Dept. K, 1301 Rock St. • Field offices in principal cities

☐ Send free copy new booklet "How You Can Simplify Control Problems and Save Money with 'Control Centers'."

Name _____

Firm Name _____

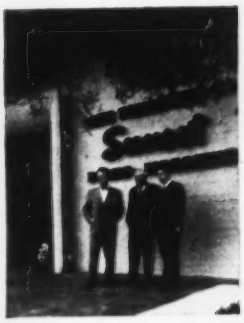
Address _____

City _____ State _____

How Honeywell Customized

Temperature Control can help you

Give your clients a better indoor climate



Why Customized Temperature Control is becoming a must for all types of buildings

Just as you often have to guide client thinking when it comes to the sort of building he really needs, today it's also important to make sure he gets proper temperature control.

Many advances have been made in temperature control which may be news to your client.

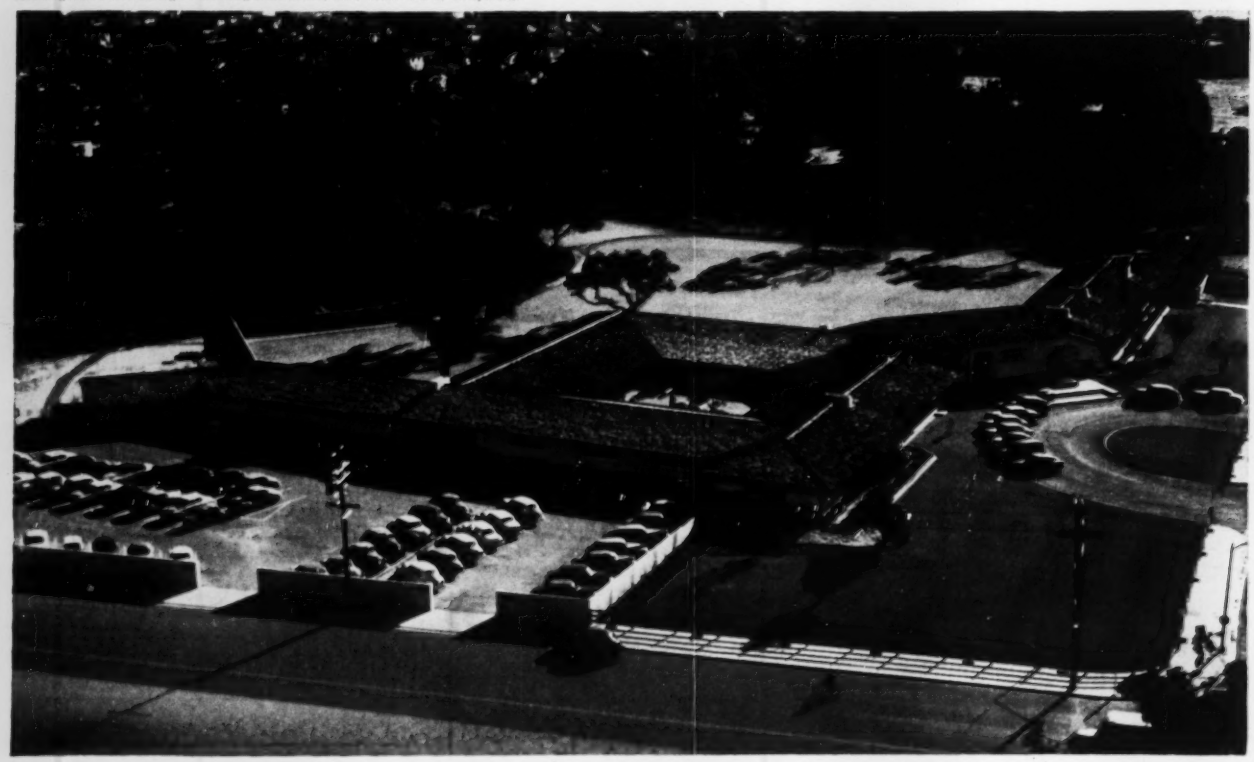
Such an advance is Honeywell Customized Temperature Control.

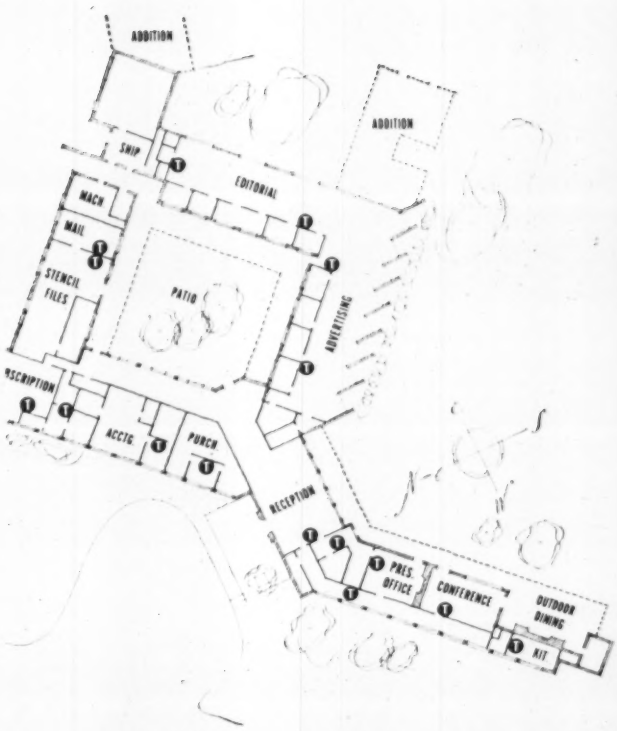
The key word here is "customized." It means that whatever your clients' control requirements, a Honeywell Customized Temperature Control installation *designed to fit the needs of the building* is your answer. This applies to heating and cooling, ventilation and humidity control, as well as industrial control.

Only Honeywell can provide true "customized" control. Because only Honeywell manufactures all three types of controls – pneumatic, electric and electronic – which often must be integrated in a single building to give you the right performance.

The story, in brief form, of how Honeywell Customized Temperature Control was used to solve specific occupancy, use and exposure problems in Sunset Magazine's "dream home" in Menlo Park, California, is told by the floor plan and the pictures and captions at right.

Sunset Magazine's Publishing Office as seen from the air. Architects: Higgins and Root, San Jose. Design consultant: Cliff May, Los Angeles. Heating contractor: Schlegel Plumbing Contractors, Inc., Menlo Park, California.





For comfortable, even temperature in new or existing buildings – of any size – use Honeywell Customized Temperature Control

Whether it's an office, motel, airport, hospital, apartment, church, school, factory, store, garage – or any size building – new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems.

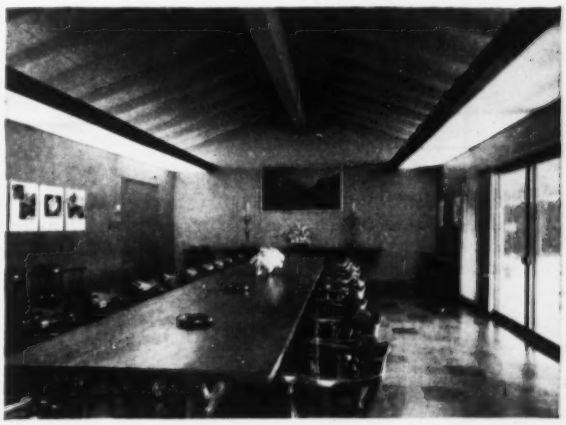
They'll not only enjoy more comfort and efficiency, they'll save fuel, too.

For full facts on Honeywell Customized Temperature Control, call your local Honeywell office. There are 104 Honeywell offices across the nation. Or mail the coupon today.

L. W. Lane, publisher of "Sunset" says,

"What we wanted was a place where workers confined by four walls could still enjoy the feeling of outdoor living. By providing us with near-perfect indoor climate, Honeywell Customized Temperature Control has contributed much to that enjoyment."

Honeywell Thermostats are giving new meaning to comfort in the headquarters of Sunset Magazine. The view above, including the editorial and advertising offices was taken from the northwest. Two thermostats are needed in this area to compensate for strong southern and western sun.



The thermostat installed in the conference room above, compensates handily for chill that sometimes comes from the large window area, keeps the temperature just right if a conference includes five persons – or twenty-five.

MINNEAPOLIS
Honeywell

First in Controls

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY
Dept. HA-11-218, Minneapolis 8, Minnesota
Gentlemen: I'm interested in learning more about Honeywell Customized Temperature Control.

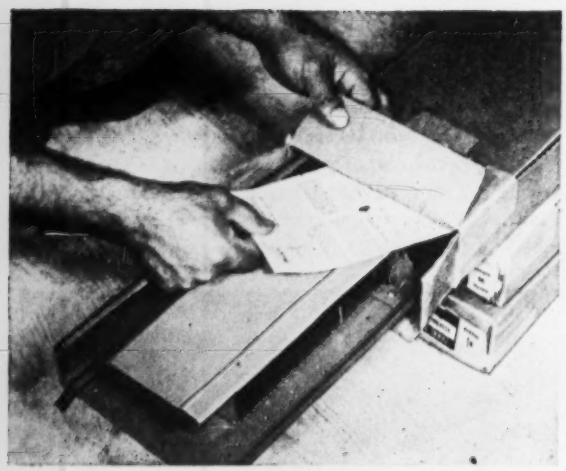
Name _____

Firm Name _____

Address _____

City _____ *Zone* ____ *State* _____

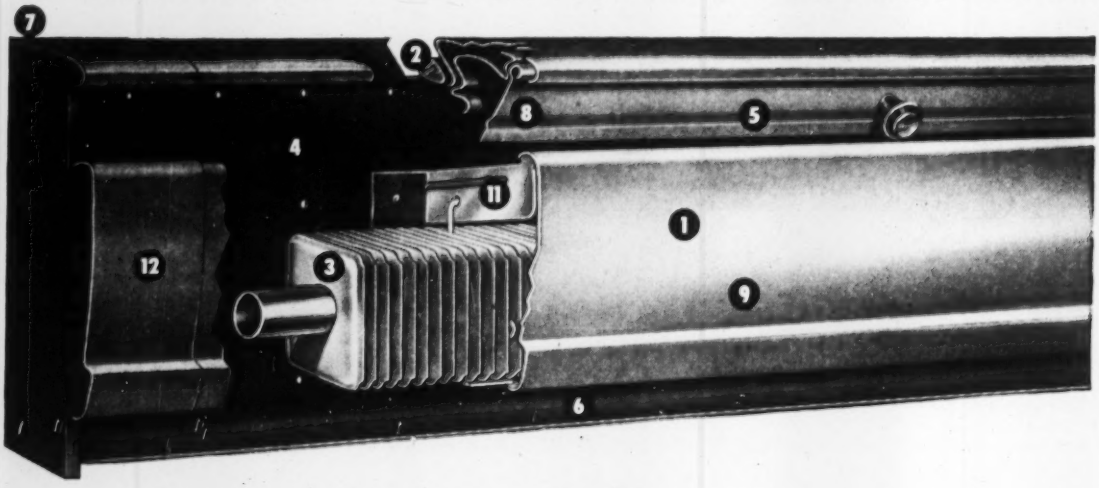
Save hours on the job with Trane Baseboard



1. Remove assembly from package! Basic Baseboard Convector unit comes *assembled* in *one package!* Just slip it out. No parts sorting. Cuts handling time ⅓. Installation instructions in carton.

2. Mount back plate in one piece! No leveling. Mounting holes are factory drilled (on 1½" centers). Fin-and-tube element hangs freely within the cabinet . . . is factory installed.

THE NEWEST ADDITION TO THE NATION'S No. 1 LINE OF MODERN RADIATION . . .

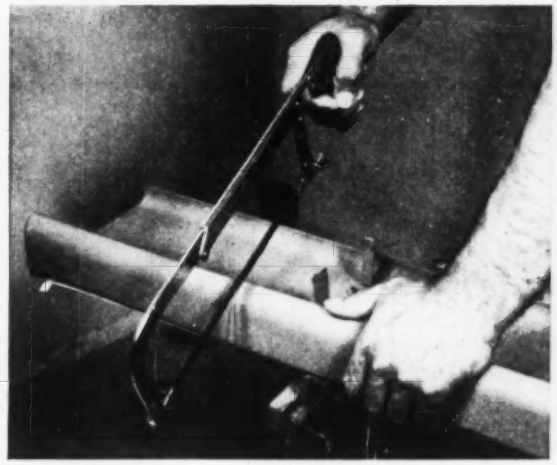


You can save labor and shave costs with this

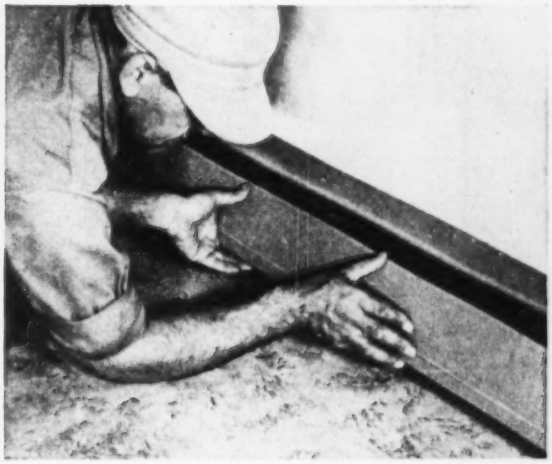
beautiful new TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING AND VENTILATING EQUIPMENT

new Convectors! Here's how...



3. Trim to fit any job dimensions! No complicated fitting. Only two cabinet parts to measure and cut. Back plate and front panel are roll-formed and contoured for extra strength and beauty.



4. Snap on front, joiners, corners! No special tools, no sheet metal screws. Snap-on joiners, end pieces, corners cover all metal edges. Even the damper snaps in. Helps cut installation time in half.

Installs easier because it's built better . . . 12 ways

1. Snap-on front—no sheet metal screws, no sheet metal drilling
2. Full-length back-to-wall rubber seal—prevents dirt seepage
3. Famous TRANE fin-and-tube—aluminum fin copper tube, mechanically bonded
4. One-piece back and top—minimum parts quickly installed, mounting holes provided
5. Uninterrupted outlet—blends unit into wall . . . prevents dirt patterns
6. Reverse radius at bottom—eliminates quarter round, speeds installation
7. Universal unit—free-standing or semi-recessed . . . 2 heights, 2 capacities
8. Snap-in damper—no screws, hinges, levers or chains
9. All parts roll and die-formed—to assure quick, accurate assembly
10. Snap-on joiner pieces—fit tightly, completely cover joints
11. Coil hanger—allows free expansion, designed to end noise
12. End caps—feature snap-on fronts for easy accessibility

TRANE CONVECTORS

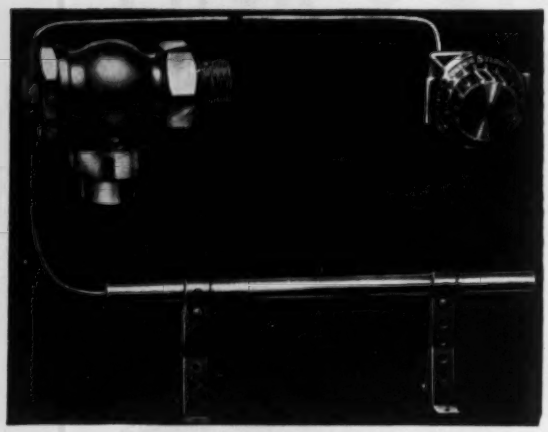
TRANE WALL-FIN

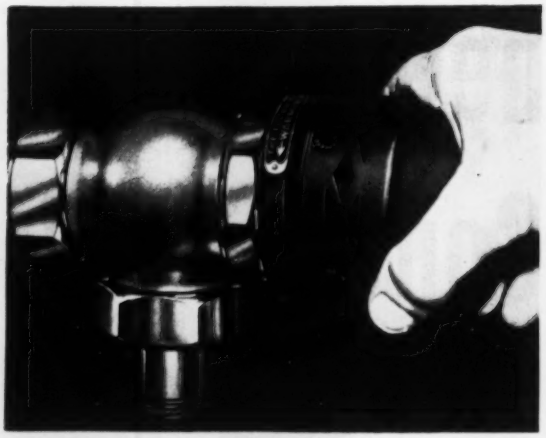
Baseboard Convector

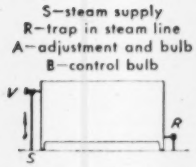
For complete information on capacities, roughing-in dimensions, control diagrams, see your nearby TRANE office or write TRANE, La Crosse, Wis.

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto • 87 U. S. and 14 Canadian Offices

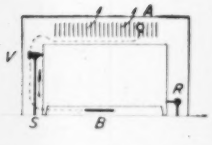
Illustrated—two basic types of Sylphon automatic radiator valves. Right, for exposed radiators. Left, for enclosed radiators. Both available in angle and globe bodies.







No. 885 on exposed radiator



No. 895 on concealed radiator

SIMPLIFIED SYSTEM *for low-cost room comfort!*

SYLPHON AUTOMATIC RADIATOR VALVES provide a simple, efficient way to get greater room comfort at lower cost—all winter long. See how effectively—how economically—they do the job.

1. These easily adjustable radiator valves assure uniform temperature control at all times—whether it's in one room, a large office or an entire building. Temperature is *kept* even. No discomfort. Result—comfort conditions and occupant efficiency are improved.

2. They substantially reduce heating costs. For studies show that during 95 per cent of the average winter season, more heat is generated than needed for healthful comfort. With Sylphon Automatic Radiator Valves controlling temperature to meet requirements, fuel is saved.

3. They cost less than any other automatic controlling system available. Easily and quickly installed on your present radiators. Simply constructed, self-powered and packless, they are self-contained and fully modulating. They pay for themselves many times over in fuel savings alone. For complete information, send for Bulletin VH-80.

FIRST WITH BELLOWS

Temperature Controls • Bellows Devices • Bellows Assemblies

FULTON SYLPHON
DIVISION

ROBERTSHAW-FULTON CONTROLS CO., KNOXVILLE 4, TENN.

Canadian Representatives, Darling Brothers, Montreal

WHY IT PAYS TO BUY STEEL FROM WAREHOUSE

You don't get caught with steel you can't use!

WHEN YOU BUY STEEL FROM WAREHOUSE, YOU GET:

- LOWER INVENTORY COSTS
- LOWER SPACE COSTS
- LOWER TIME COSTS
- LOWER CAPITAL INVESTMENT
- FASTER PRODUCTION
- FEWER INVENTORY LOSSES

You can avoid this costly possibility by using the nearest U. S. Steel Supply warehouse as your own. From it, you can get the steel you need . . . in large or small quantities . . . cut to your specifications . . . delivered to your production area . . . at the time you desire. You run no risk of inventory obsolescence. Your U. S. Steel Supply salesman will help you put your steel purchasing on a most economical and efficient basis.

U. S. STEEL SUPPLY

DIVISION

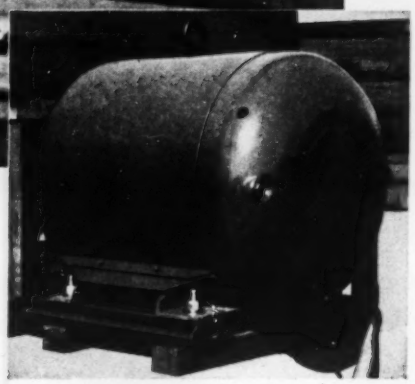
General Office
208 So. La Salle St., Chicago 4, Ill.

USS

Warehouses and Sales Offices Coast to Coast

UNITED STATES STEEL

8 cell cooling tower driven by 8 Wagner Multi-speed Motors.



Here's a job for *Rugged* motors

This 8 cell Marley Cooling Tower, at Pueblo, Colorado, provides a steady supply of 6600 gallons of cooling water per minute for a steam power plant. There are 8 fans with blades 22 feet in diameter that are driven, through gear reducers, by 8 Wagner two-speed, totally-enclosed fan-cooled motors. These 440 volt motors are each rated 75/19 hp.

Cooling towers need motors with plenty of stamina. They must operate without attention, day in and day out, completely exposed to all kinds of weather.

Wagner totally-enclosed fan-cooled motors are built to operate under severe conditions. They are available in steel or cast iron frames, in standard or explosion-proof types, single-speed or multi-speed, single phase, 2 phase or 3 phase, in ratings to 250 hp.

For your requirements, there is a Wagner Motor to fit every need—a complete line for all current specifications, with a wide variety of enclosure types and mountings. Bulletin MU-185 gives full information. Do you have a copy?

Your nearby Wagner engineer will be glad to help you select the *right* motors for your next application. Call the nearest of our 32 branch offices, or write us.

® Wagner Electric Corporation
EST. WE 1891

WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

M53-18

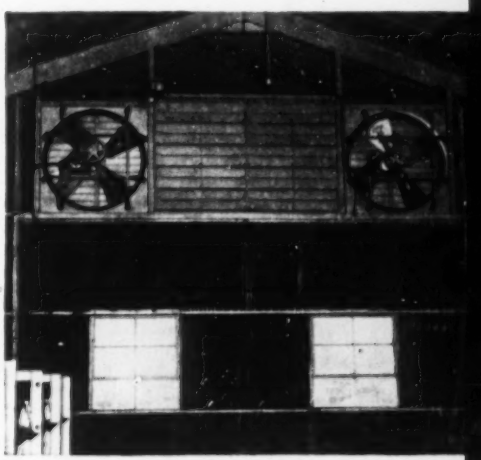
High-Performance Blades!

—on these world-famous helicopters and the "Buffalo" FANS in their plant

Out of the heat treat building of the Piasecki Helicopter Corporation in Morton, Pa., come precision-made parts like the rotor blades raising this big, new Piasecki H-21 "Work Horse" Helicopter.

Doing another "Work Horse" job in that building are other blades — the wheels of the "Buffalo" Heavy Duty Belt-Air Fans constantly exhausting the hot air from the process. In these blades, as in helicopter blades, balance must be perfect for freedom from vibration. Blade shape must be for high efficiency, that is, most delivery on least power. Overall construction must be extremely rigid and strong. "Buffalo" Belt-Air Fans fulfill these conditions to perfection.

If you have an air moving job from 4,000 cfm to 90,000 cfm and up to 1" pressure, your best and lowest cost solution may well be one of these rugged propeller fans. Why not write for literature today?



"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

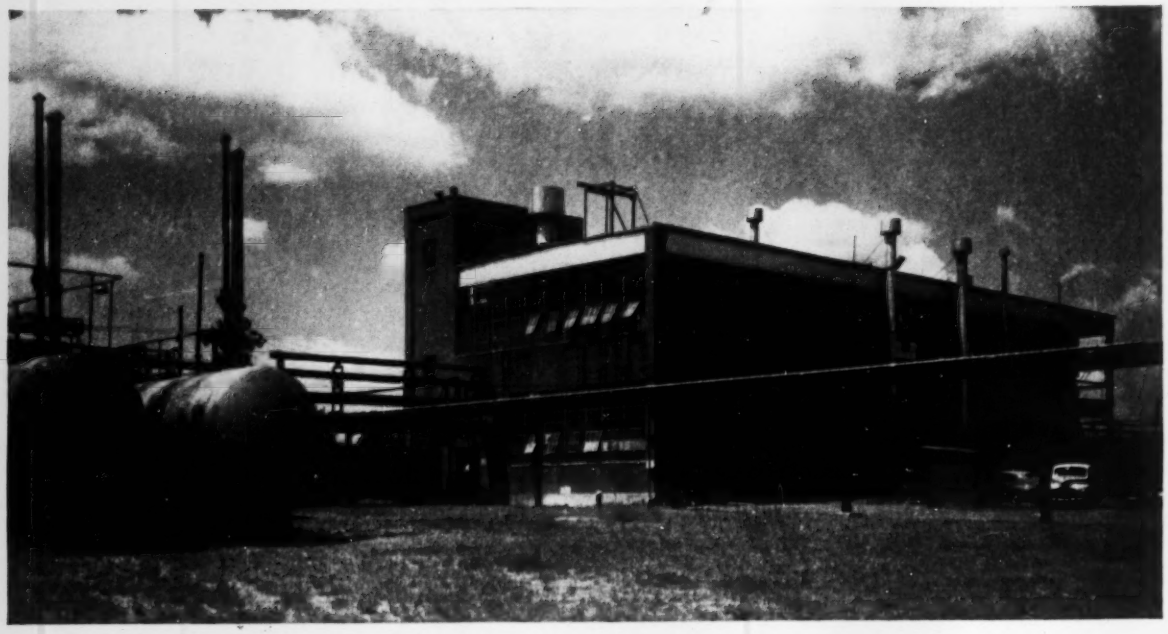
171 MORTIMER ST. BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

VENTILATING FORCED DRAFT | AIR WASHING COOLING | AIR TEMPERING HEATING | INDUCED DRAFT PRESSURE BLOWING | EXHAUSTING

Oh, I see



. . . they're using our valves at GOODYEAR

The Goodyear Chemigum Plant at Akron relies on perfect valve functioning . . . precise flow control with valves that are dependable, just as you may. Their choice throughout this plant is OIC.

You pay no extras for OIC's precision engineering, even though you do get longer, trouble-free valve service. In addition, OIC offers you engineering assistance to help you select valves best suited for the job.

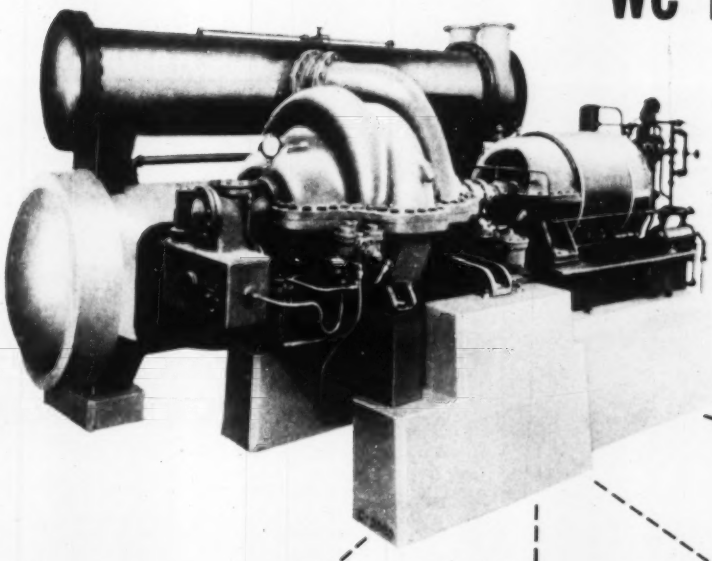
If you could see them made, you'd make OIC Valves your first choice when you want dependability.

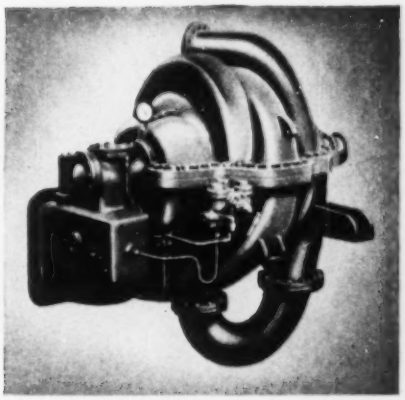
THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

OIC FOUNDED 1883

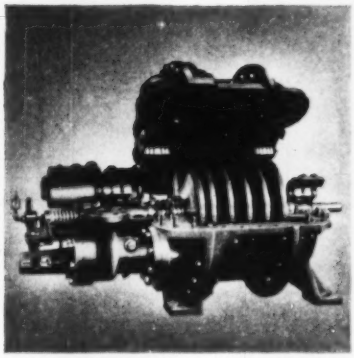
VALVES | **FORGED & CAST STEEL, IRON & BRONZE, LUBRICATED PLUG VALVES**

We know it'll do a job for you . . . we built all of it!

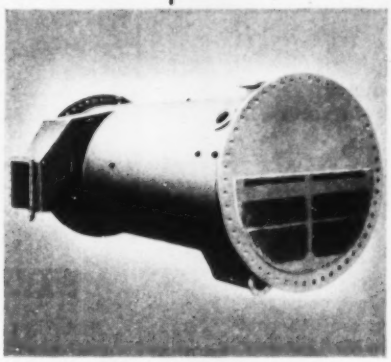




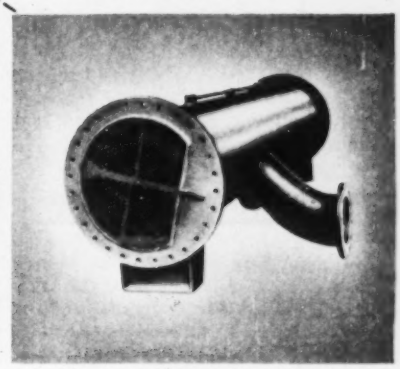
INCREASED EFFICIENCY results from volute design of the Worthington centrifugal compressor. Smooth, obstruction-free passage for gas reduces friction and turbulence losses.



TYPICAL WORTHINGTON MULTI-STAGE steam turbine, ideally suited for compressor-drive applications.



OVERALL SAVING in power consumption is made possible by the flash pre-cooling chamber in the Worthington cooler.



WORTHINGTON CONDENSERS are of the horizontal shell-and-tube type, with water inside the tubes and refrigerant gas outside.

Every major component in a Worthington centrifugal refrigeration system is designed, engineered and built at the Worthington plant. Worthington, for example, is the only manufacturer that builds drives as well as compressors.

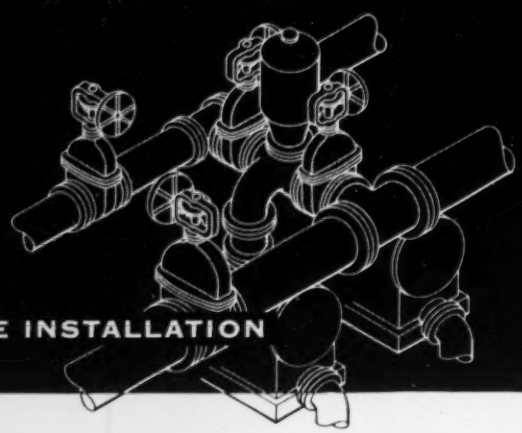
This is one big reason why leaders in industry are turning more and more to Worthington centrifugal refrigeration systems. Present-day installations include CBS Television City; the new Alcoa Building, Pittsburgh; Saks Fifth Avenue; the Hotel Commodore, and the General Petroleum Building in Los Angeles.

Worthington also makes condensers, coolers and auxiliary equipment such as steam condensers, condensate pumps, steam jet air ejectors and step-up gear sets. Write for free Centrifugal Refrigeration Bulletin C-1100-B14 to Worthington Corporation, Air Conditioning and Refrigeration Division, Harrison, New Jersey. A-3-41

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

These Valves Stay on Job After 50 Years of Water Service



THE INSTALLATION

At the Beaumont City Water Works, Beaumont, Texas, with Crane gear-operated iron body gate valves in main lines in pumping plant.

VALVE SERVICE RATINGS

SUITABILITY: *Always reliable*

FEATURES: *Rugged design in every part*

MAINTENANCE COST: *Routine care only*

SERVICE LIFE: *Still in service—since 1903*

OPERATING RESULTS: *No valve failures*

AVAILABILITY: *Crane Catalog item—Current No. 461*

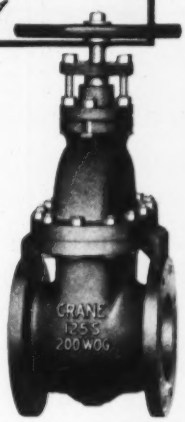
THE CASE HISTORY

Beaumont taxpayers are still benefiting by the valve quality specified for the Municipal Pumping Station built in 1903. These 14, 16, and 24-inch Crane iron body gate valves remained in their original location until the old plant was converted recently from steam to diesel power. Even then, many were merely cleaned up and put right back in service in the new plant.

For 50 years and more, these Crane valves have given outstanding service at the lowest possible maintenance cost. With but routine care, they remained tight at seat and stem, and always performed with smooth, positive action, despite infrequent operation.

Here's an example of the quality that traditionally sets Crane apart from ordinary valves. It's value like this that has always made Crane the first choice of thrifty buyers in every industry.

THE VALVE



Today's Crane 125-Pound Iron Body Gate Valves with wedge disc are building equally outstanding service records. Highly engineered for durability and dependability at low cost, these valves are now available in the most complete line of patterns and sizes, with a choice of trim for water utilities and other services. Choose to your exact needs from your Crane Catalog, or see your Crane Representative.

THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

ROCHESTER GAS & ELECTRIC SPECIFIES . . . .

GUN-PAKT EXPANSION JOINTS

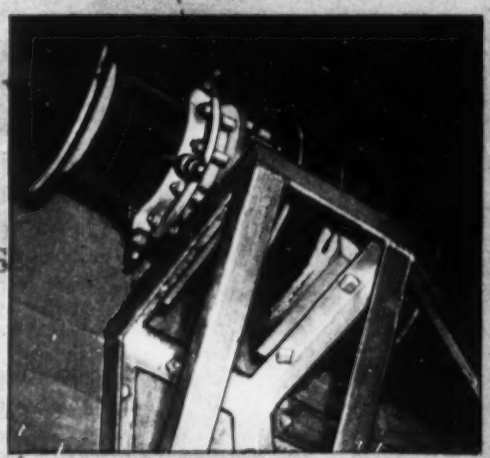
USER OF GUN-PAKT JOINTS SINCE 1935 ORDERS 16 MORE FOR NEW STEAM LINE

This prominent New York State utility has been using Yarway Gun-Pakt Expansion Joints for the past 17 years. Now they have ordered 16 more (12", max. working pressure 400 psi) for a new steam distribution line in their expanding system—pretty good proof that Gun-Pakt Joints give trouble-free, economical service.

Central station heating plants, institutions and industrial plants all over the country are finding Gun-Pakt Joints offer *maximum protection* with *minimum maintenance*. Gun-Pakt Joints are *rugged, strong* joints. They offer freedom from shutdowns because they are *serviced under full steam pressure*. Maintenance costs are low; one utility that kept accurate records found their maintenance costs to be only 65c per year per joint!

To service a Gun-Pakt Joint you simply insert a plug of packing, twist a wrench, and the joint is tight . . . the job done . . . all without taking pressure off the line.

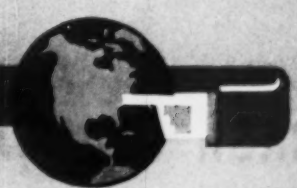
Yarway engineers, conveniently located near you, are constantly working for better, more profitable steam plant operation. Call on your Yarway man for friendly, helpful advice.



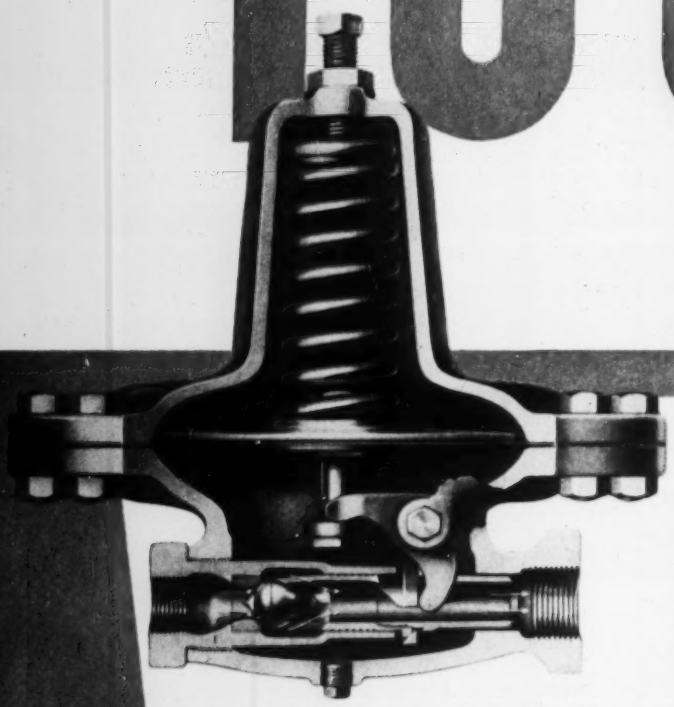
Yarway Gun-Pakt Expansion Joint installed in Rochester Gas & Electric Corporation's Broad St. subway line. 10" joint, 225 lbs. pressure, 450°F.

YARNALL-WARING COMPANY
107 Mermaid Avenue, Philadelphia 18, Pa.
Branches in principal cities

YARWAY SERVICE GOES ALL THE WAY . . .



TYPE 1000 VALVE



Any product of quality should be dependable when *ordinary* products fail. Sudden pressure fluctuations, dirt, scale and viscous matter prove "fatal" to ordinary pressure reducing valves.

The CASH STANDARD TYPE 1000 VALVE however, is designed to operate with complete dependability under the most difficult and unusual circumstances. Many of these units have been in service over 10 years and have never been taken "out of the line."

Truly an *EXTRAORDINARY* achievement of quality and design excellence.

INSTALL CASH STANDARD "TYPE 1000" VALVES

CASH STANDARD **DECATUR, ILLINOIS**

A. W. CASH COMPANY

VILTER COMPRESSORS
equipped with
ALLEN-BRADLEY
TROUBLE FREE MOTOR CONTROLS

A-B Quality

Vilter Compressors, equipped with Allen-Bradley motor controls, installed at Morris Harvey College, Charleston, W. Va.

Why are Allen-Bradley automatic starters so popular for refrigeration and air-conditioning service? . . . Because they are trouble free.

Why are they trouble free? Only ONE moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install them . . . and forget them! No contact maintenance . . . Allen-Bradley cadmium silver alloy contacts never need cleaning, filing, or dressing.

Dependable overload relays . . . Allen-Bradley thermal relays are accurate and always dependable . . . even after years and years of service.

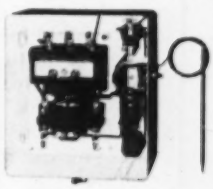
The Allen-Bradley trademark stands for millions of trouble free operations. Specify Allen-Bradley controls, today.

Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.

WRITE
for this
Allen-Bradley
Air Conditioning
and Refrigeration
Bulletin

Specify Allen-Bradley Standard Controls. For "Engineered" Special Refrigeration Controls—Consult with Allen-Bradley.

Allen-Bradley offers a wide line of air-conditioning and refrigeration controls—pressure and temperature controls, manual and automatic starters, and special refrigeration control units, consisting of various combinations of the above units.



A typical Allen-Bradley special refrigeration control unit. Note roomy enclosure.

ALLEN-BRADLEY QUALITY MOTOR CONTROLS

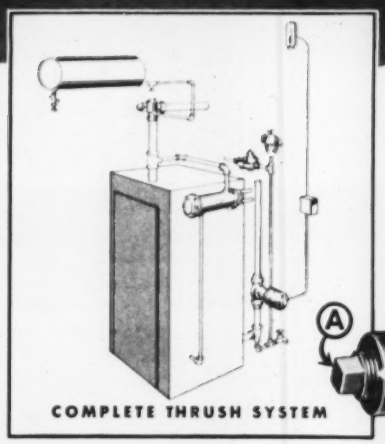
it's NEW!

THRUSH Tank Drain

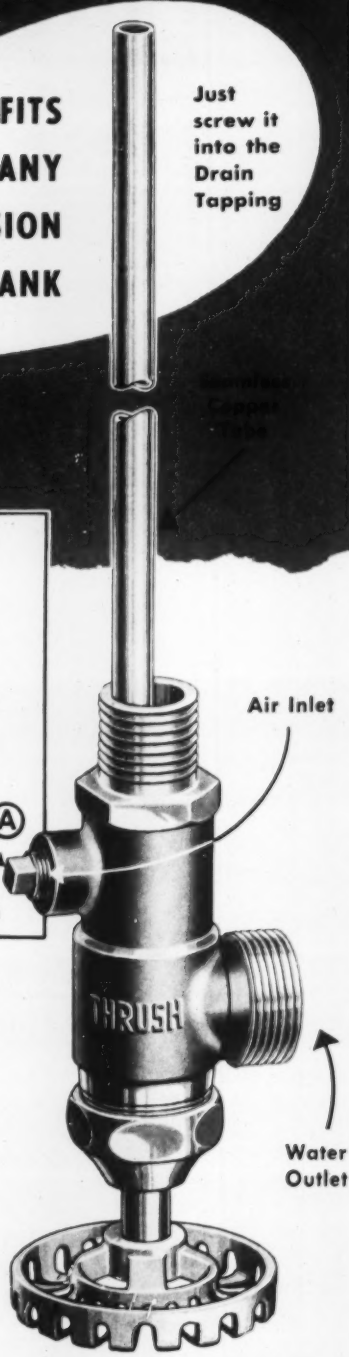
Reduces DRAINING TIME

FITS ANY EXPANSION TANK

Just screw it into the Drain Tapping



- A simple, inexpensive valve combining air tube and drain.
- Fits drain tapping . . . easily installed . . . inexpensive. Two tube lengths.
- Eliminates guesswork, saves time. A few minutes drains the average size tank.
- Pleases home owner, pays for itself on the first draining.

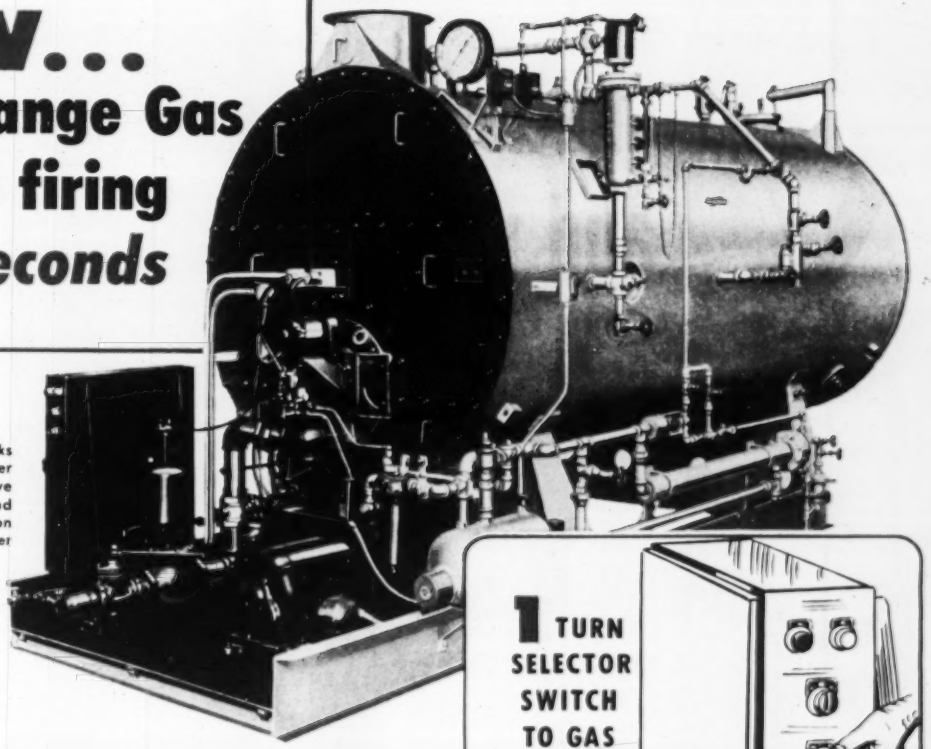


A REAL CONVENIENCE
and profit maker too!

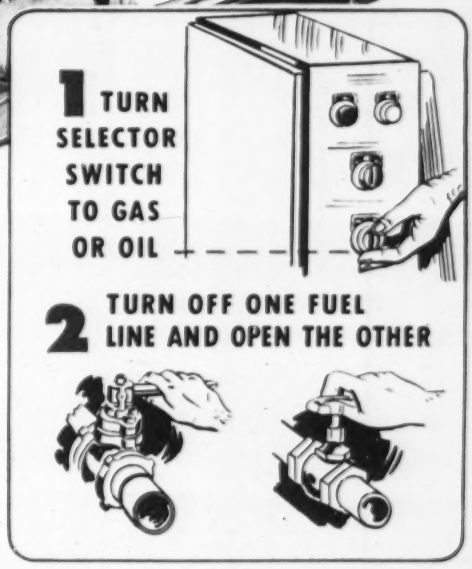
DRAINING waterlogged pressure tanks is simple, quick and positive if you'll install a Thrush Tank Drain. While all genuine Thrush Pressure Tanks now come equipped with the Thrush Vacuum Breaker, there are many older installations where the tank has only one drain tapping. Now you can enjoy the same convenience in tank draining on these older jobs, too. The Thrush Tank Drain combines Vacuum Breaker and Drain Valve in one inexpensive fitting. When the tank needs draining, simply open drain, remove plug "A" to break the vacuum and tank will drain completely. It is a profit item you can sell all year through. For more information, see your wholesaler or write Department E-11.

THRUSH A COMPANY · Peru, Indiana

NOW... interchange Gas and Oil firing in *10 seconds*



Modern Cleaver-Brooks Model LR Steam Boiler Equipped with Exclusive Cleaver-Brooks "10-second conversion" Combination GAS and/or OIL Burner



TWO, simple motions eliminate time-consuming change-over

Now you can use oil or gas at the flick of a switch! This exclusive new Cleaver-Brooks development permits changeover from oil to gas or vice versa in only 10 seconds.

That's because the Cleaver-Brooks Combination Gas and/or Oil Fired Boiler operates on gas *with the oil burner in place*. Simply flipping a selector switch on the control panel to either gas *or* oil sets the proper circuit in action. Turning the convenient fuel supply valves completes the entire changeover — and in 10 seconds or less!

To gas users in all parts of the country — and in particular areas where local requirements demand immediate changeover — this exceptional fuel flexibility can be an important factor in determining your overall operating economy.

Ten-second conversion, like 4-pass construction, self-contained design, guaranteed 80% efficiency, is another "plus" feature pioneered by Cleaver-Brooks. It demonstrates Cleaver-Brooks' continuing effort to bring steam users even greater flexibility and reduced operating costs.

If you are considering simplifying your present boiler plant, remember Cleaver-Brooks Combination GAS and/or OIL Fired Boilers. Sizes 15 to 500 h.p. — 15 to 250 p.s.i. Write for complete facts.

Cleaver-Brooks

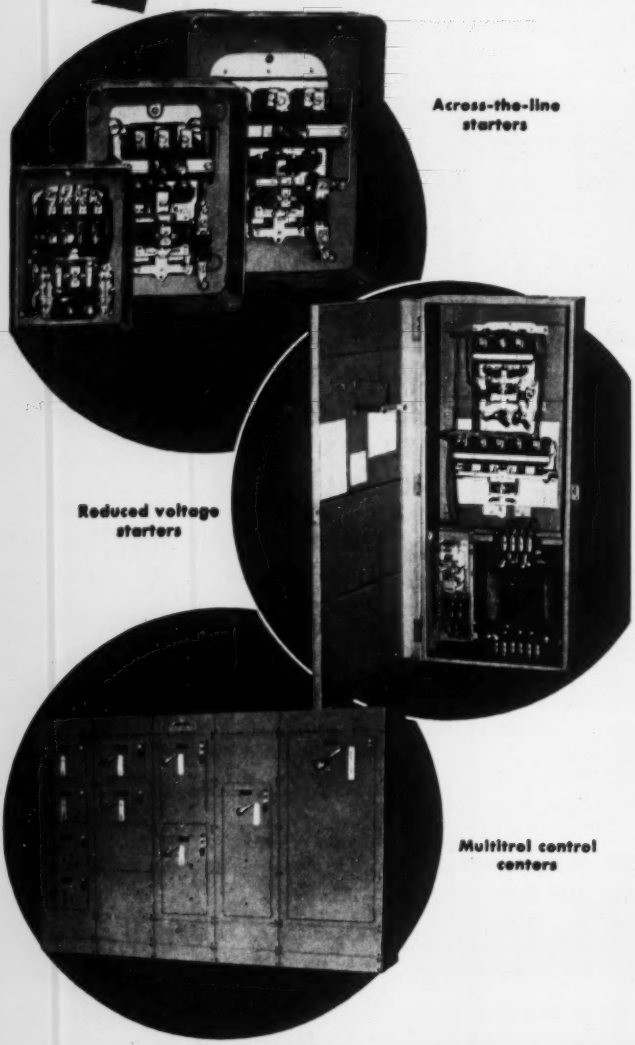
Originators of the Self-Contained Steam Boiler

CLEAVER-BROOKS COMPANY

Dept. M-313 E. Keefe Ave., Milwaukee 12, Wis., U.S.A.
Cable Address: Clebro-Milwaukeewis

Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners

Here's a sound starting point for air conditioning, industrial heating, and refrigeration sales



Across-the-line starters

Reduced voltage starters

Multitrol control centers

In the long run, leading users of motor starting equipment have found it highly profitable to specify motor controls made by Ward Leonard.

Why? Because installation of Ward Leonard starters is easy, performance is trouble-free, operating life is exceptionally long and maintenance is simplified.

Ward Leonard manufactures a complete line of dependable motor starters for refrigeration, air conditioning and industrial heating applications. Here are the five distinct types of Ward Leonard starters:

Bulletin 4110 – a-c across-the-line magnetic – non-reversing, 200 hp max.

Bulletin 4170 – a-c Primary resistance, 200 hp max.

Bulletin 4190 – a-c Autotransformer, 200 hp max.

Bulletin 4340 – a-c Part Winding, 400 hp max.

Bulletin 4410 – Multitrol control centers NEMA size five, 600 v. max.

For full particulars on these and other motor controls, send for your copy of Ward Leonard's Motor Control Catalog. Ward Leonard Electric Co., 24 South St., Mount Vernon, N. Y.

WARD LEONARD ELECTRIC COMPANY
MOUNT VERNON, NEW YORK

RHEOSTATS RELAYS RESISTORS CHROMASTER

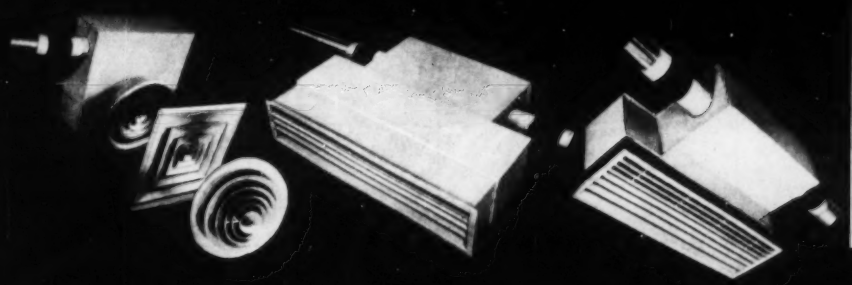
Result-Engineered Controls Since 1892

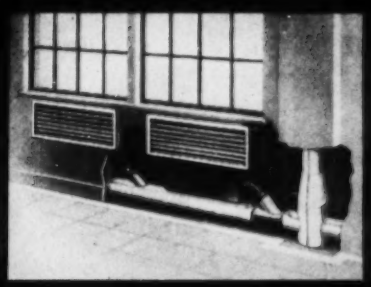
Ward Leonard's complete engineering textbook, "Handbook of Power Resistors," $3 per copy.

No matter ***which***

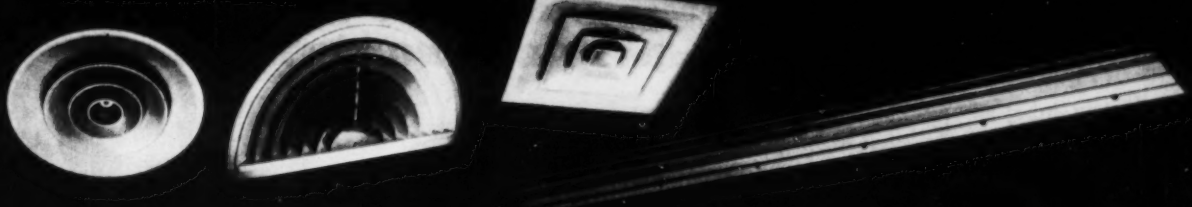
air conditioning system you use...

HIGH VELOCITY





OR CONVENTIONAL



when these are in sight the installation is right

ANEMOSTAT®

DRAFTLESS *Aspirating* **AIR DIFFUSERS**

ANEMOSTAT CORPORATION OF AMERICA

10 EAST 39th STREET, NEW YORK 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

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AC-1514

Highly specialized process controls are used to produce the finest in seamless WELDING FITTINGS

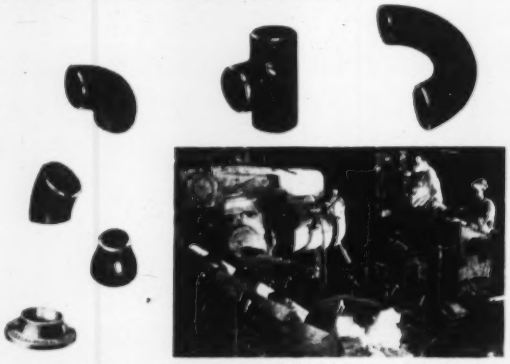
Only Globe, among manufacturers of welding fittings, produces its own seamless steel tubes. Specialized processes at every stage of manufacture from billet to tube — to fitting — insure uniform high quality. Thorough inspection and continuous laboratory control guarantee strict conformity to rigid specifications.

Now . . . you can get these high-quality fittings when you need them — in the quantities you want. Just get in touch with your nearest Globe distributor.

GLOBE STEEL TUBES CO., Milwaukee 46, Wisconsin
Chicago • Cleveland • Detroit • New York • Philadelphia • St. Louis
Denver • Houston • San Francisco • Glendale, Cal.

Producers of Globe Welding Fittings — Globe seamless stainless steel tubes — alloy — carbon seamless steel tubes — Gloweld welded stainless steel tubes — Globeiron (high purity ingot iron) seamless tubes.

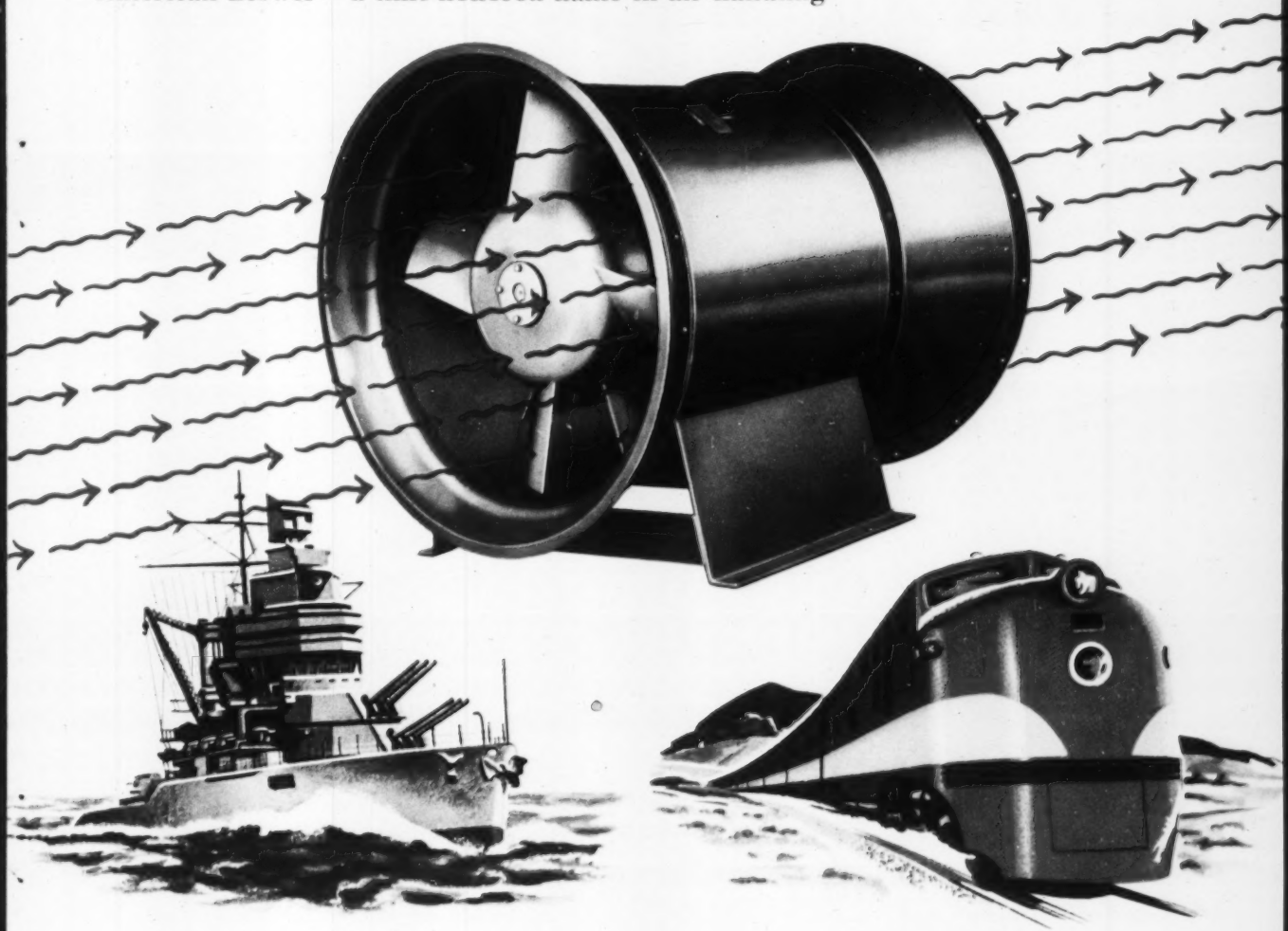
AVAILABLE IN A COMPLETE LINE OF SIZES AND WEIGHTS THROUGH GLOBE DISTRIBUTORS IN ALL KEY CITIES



Here is one of the highly specialized manufacturing operations that insure Globe quality — piercing the billet to form a seamless tube.

Send for the Globe Welding Fittings catalog.

American Blower – a time-honored name in air handling



Dependable, low cost ventilation!

The Navy demands it on battlewagons . . .

Railroads specify it for modern streamlined trains . . .

Commerce and industry require it for the conduct of profitable business . . .

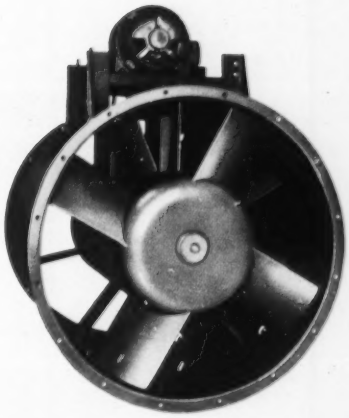
No one company has done more to provide dependable low cost ventilation than American Blower.

For example, American Blower Axial Fans are widely used in thousands upon thousands of varied applications, and are unsurpassed for ease of installation and efficient performance.

For complete information on axial fans and other American Blower Air Handling equipment, contact our nearest branch office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation



American Blower Axial Fans are smooth in performance, built for endurance and convenient to install.

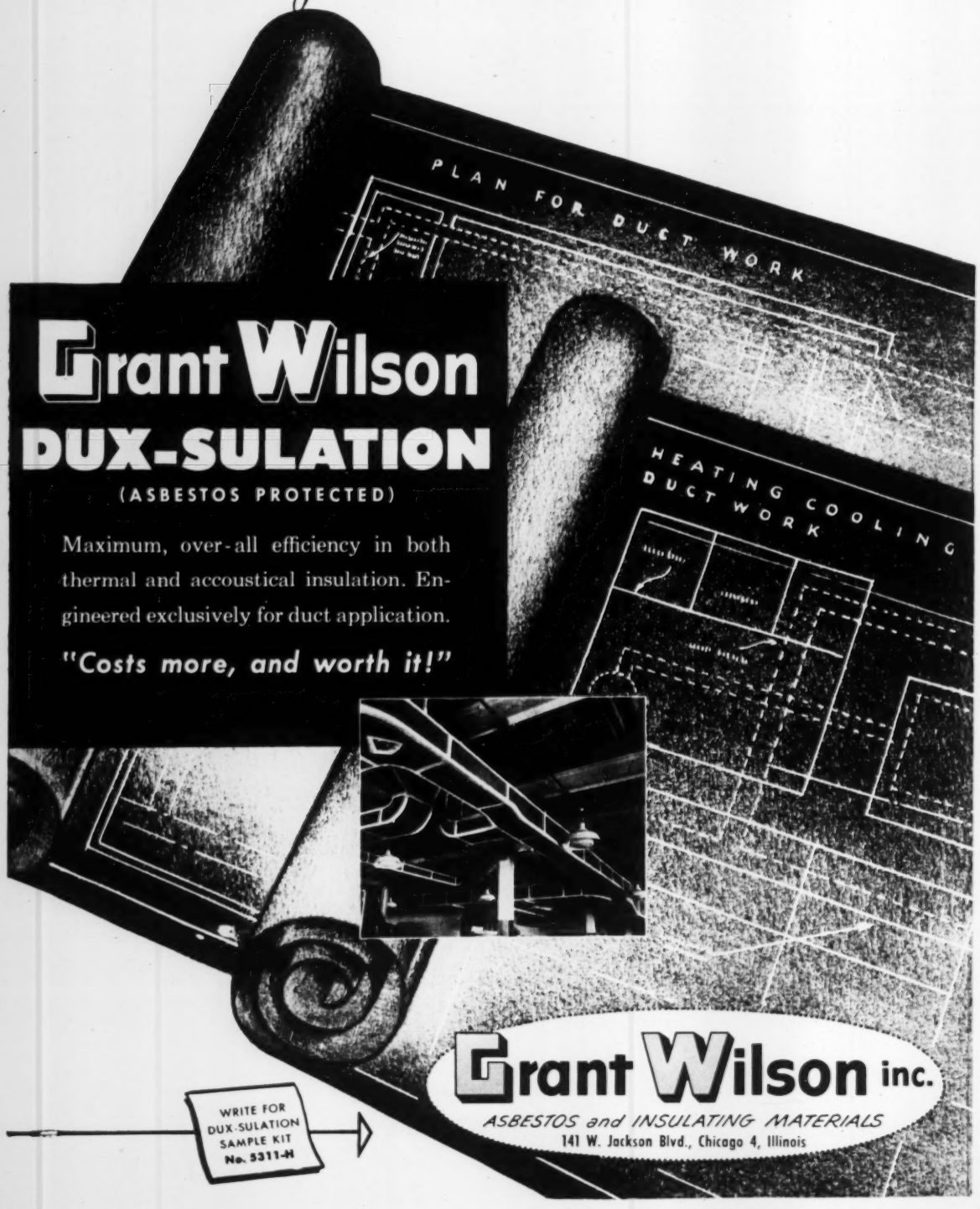
AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS EXCHANGERS

For projects where nothing but the BEST is desired.....
where nothing less than the BEST is acceptable....



Grant Wilson
DUX-SULATION
(ASBESTOS PROTECTED)

Maximum, over-all efficiency in both thermal and accoustical insulation. Engineered exclusively for duct application.

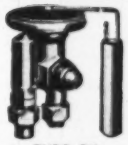
"Costs more, and worth it!"

WRITE FOR DUX-SULATION SAMPLE KIT No. 5311-H

Grant Wilson inc.
ASBESTOS and INSULATING MATERIALS
141 W. Jackson Blvd., Chicago 4, Illinois

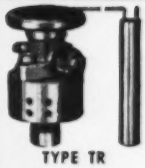
THERMO EXPANSION VALVES

TYPE 402 with pressure limiting feature



TYPE TK "3 valves in 1"

TYPE TCL



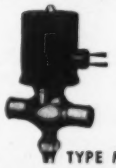
TYPE TR Multi-Outlet

For automatic control of liquid refrigerant on all types of refrigeration and air conditioning systems. Capacities from fractional tonnage to 50 tons "Freon-12", 100 tons Methyl Chloride. Low temperature valves for −40° F. to −100° F.

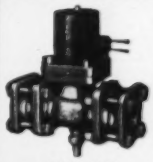
SOLENOID VALVES

TYPE S1

TYPE S2



TYPE M3



TYPE R2

For all types of service. For liquid: "Freon"—up to 75 tons. Methyl Chloride—up to 150 tons. For suction: "Freon"—up to 8.8 tons. Methyl Chloride—up to 17 tons. For brine, water, gas, air and steam.

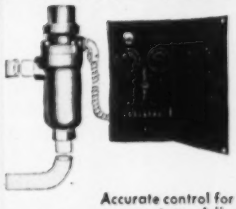
FLOAT VALVES AND SWITCHES

TYPE HK high pressure float valve

Up to 5 tons "Freon-12", 10 tons Methyl Chloride and 20 tons Ammonia.

TYPE J5 electric float switch

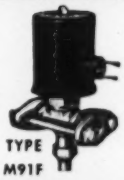
For "Freon", Methyl Chloride, Ammonia and other non-corrosive liquids having a specific gravity of .6 or more. Up to 460 volts AC and 250 volts DC.



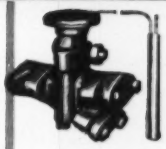
908 LECTRO-LEVEL electronic remote control of liquid level

Accurate control for full-flooded evaporators. Adjustable to a wide range of level changes. Easy-to-set control dials conveniently mounted in remote box. Successfully used for over 5 years.

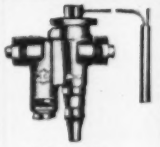
AMMONIA CONTROLS



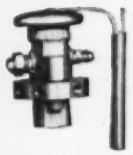
TYPE M91F



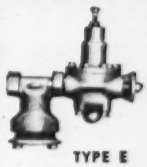
TYPE TG



TYPE UG

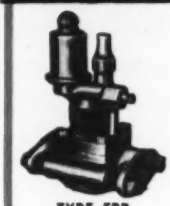


TYPE TX



TYPE E with Strainer

SUCTION LINE CONTROLS

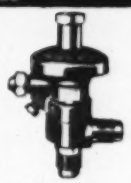


TYPE EPR

For all refrigerants with connection sizes up to 6"

TYPES 771-772 SUCTION PRESSURE REGULATORS HOLD-BACK VALVES

Prevent motor overload. Freon-12, Freon-22.



TYPE 760 "EVAPOTROL"

Pressure regulator—½ ton, "Freon-12"—¾ ton, Methyl Chloride.

Solenoid Liquid Valves — up to 172 tons. Solenoid Suction Valves — up to 28 tons. Thermo Expansion Valves—from fractional tonnage to 125 tons. Automatic Expansion Valves — from fractional tonnage to 60 tons.

ALCO VALVES

the COMPLETE LINE of refrigerant controls

For capacities in excess of those listed, write us for further details and give specific requirements.

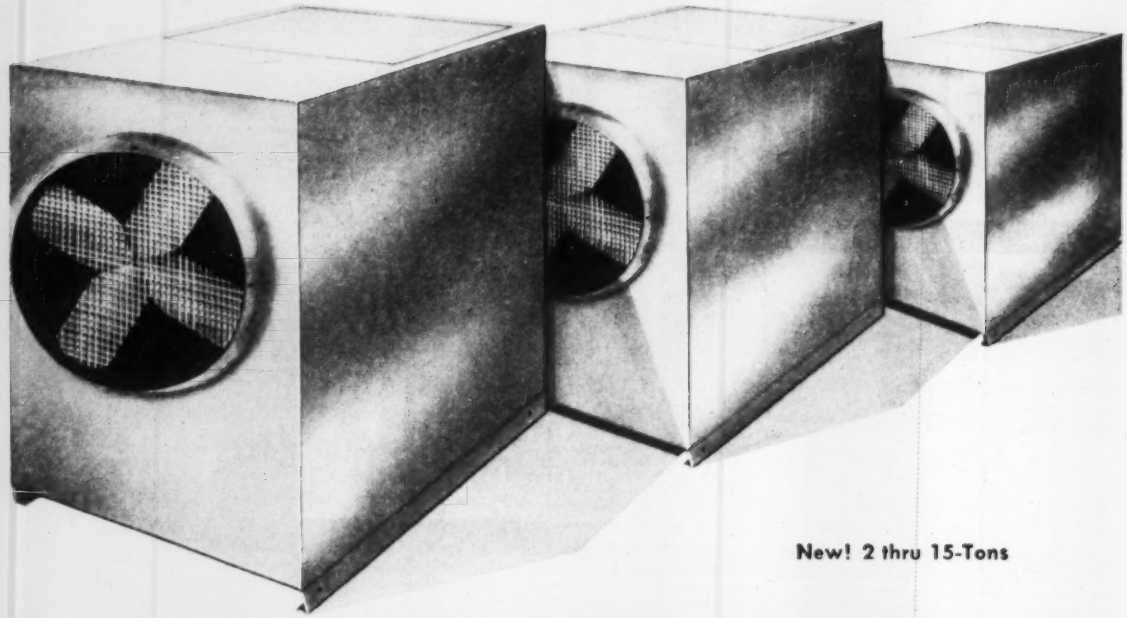
ALCO ALSO MAKES: Constant Pressure Expansion Valves — Liquid and Suction Line Strainers.

AVAILABLE AT YOUR WHOLESALER'S

ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

RESIDENTIAL COOLING TOWERS



New! 2 thru 15-Tons

ONLY HALSTEAD & MITCHELL OFFERS THE

20-Year Guarantee!

ON THE WETTED DECK SURFACE

PRICED FOR THE HOME MARKET

Price-wise these Halstead & Mitchell Residential Cooling Towers throw open huge segments of the home and small building market to air-conditioning. Here is the development for which the industry has been waiting. Check prices today!

NOW REQUIRED IN MANY AREAS

Residential Cooling Towers recirculate precious water . . . meet requirements of municipalities which prohibit wasting cooling water to sewers. And low cost H&M units take residential air conditioning to the suburbs and rural area . . . recirculate from a cistern if need be!

MADE FOR REAL OPERATING ECONOMY

Economical, lastworthy . . . low operating cost matches low initial cost. Efficient gravity-type distributing pan eliminates windage loss since atomizing by spray nozzle is unnecessary. Low pump head pressure is another bonus of gravity distribution. And maintenance is a snap!

FAMOUS HALSTEAD & MITCHELL QUALITY

Here's *all* the quality for which Halstead & Mitchell Cooling Towers are world famous — including the 20-year Guarantee on the wetted deck surface of pressure-treated creosoted wood, against attack by rotting or fungi growth. Stainless steel fans and shafts, plus individual cabinet coatings of Vinsynite, Vinyl Zinc and chlorinated rubber add important years of life. The complete assembly is with Everdur bolts . . . disassembly is easy even after years of service.

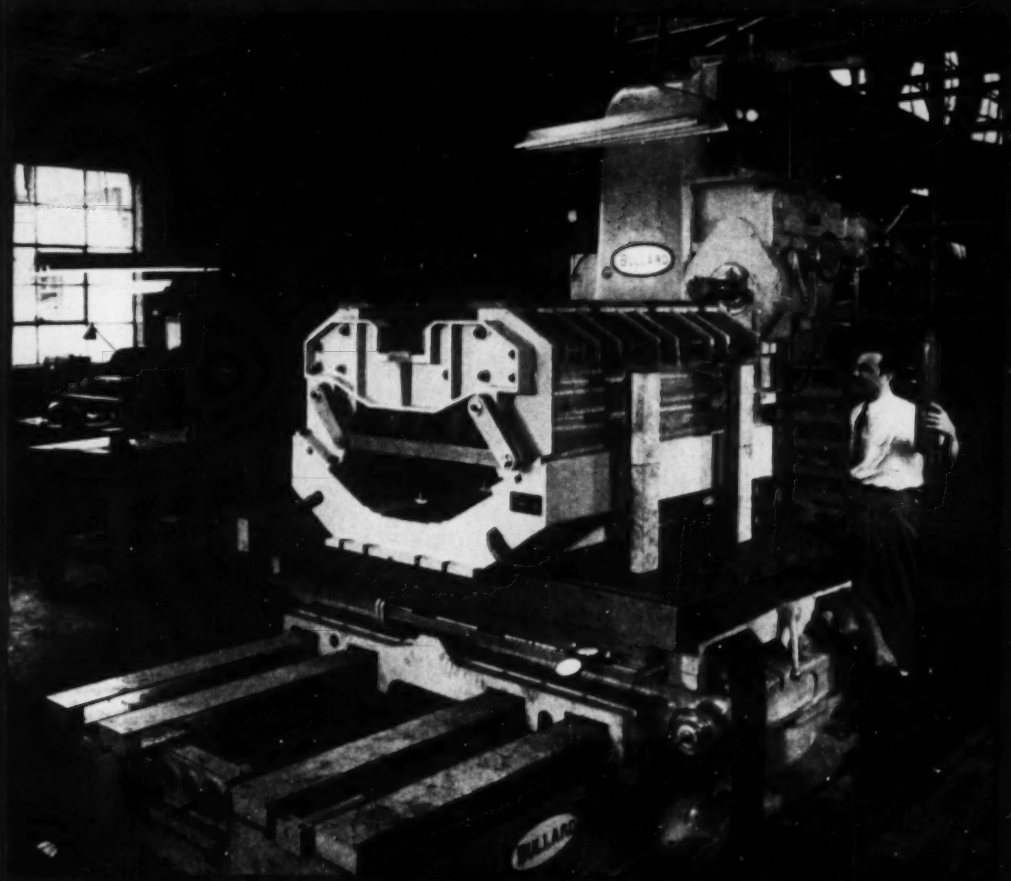
AT LEADING WHOLESALERS EVERYWHERE

Write for descriptive bulletin from Halstead & Mitchell, one of the world's largest manufacturers of water-cooled Cleanable Condensers, and Cooling Towers up through 100-tons.

Halstead & Mitchell

OFFICES: BESSEMER BUILDING • PITTSBURGH 22, PA.

ENGINEERED BY BULLARD



To _____
Make Light Work
Of Tough Jobs

THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT

Telephone
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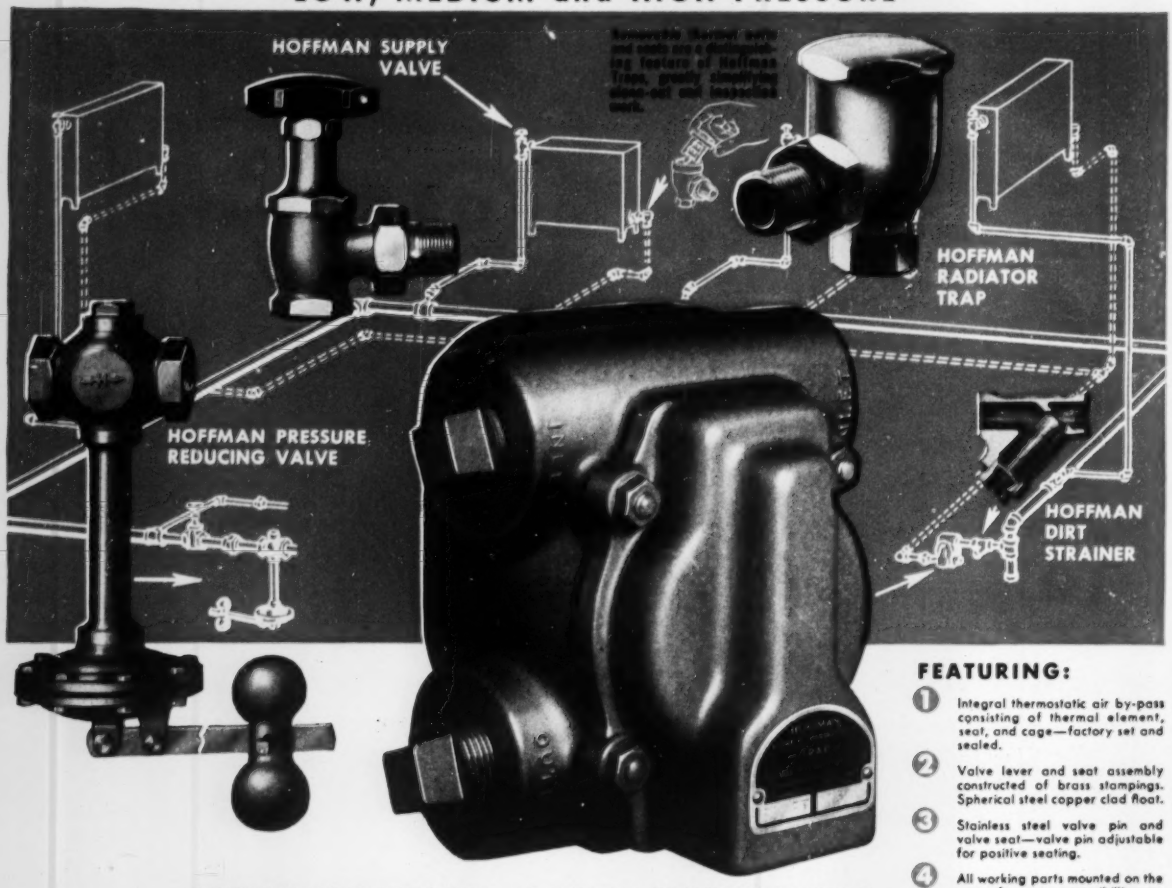
HOFFMAN NEW 50 SERIES

FLOAT and FLOAT & THERMOSTATIC TRAPS

LOW, MEDIUM and HIGH PRESSURE



FEATURING:

1. Integral thermostatic air by-pass consisting of thermal element, seat, and cage—factory set and sealed.
2. Valve lever and seat assembly constructed of brass stampings. Spherical steel copper clad float.
3. Stainless steel valve pin and valve seat—valve pin adjustable for positive seating.
4. All working parts mounted on the cover for easy accessibility—no pipe connections to break.

MECHANICAL FLOAT TRAP WITH EXTERNAL BY-PASS

FOR PIPE COILS

FOR UNIT HEATER

HOFFMAN 50 SERIES FLOAT and FLOAT & THERMOSTATIC TRAPS

Sizes: ¾" to 2" **Pressures: ½ lb. to 125 lb.**

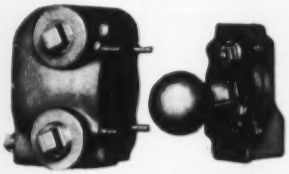
Again Hoffman provides industry with an improved product, refined to *function more effectively and economically in removing condensate.*

Hoffman engineers thus anticipate industrial steam heating trends that demand less maintenance and operating costs.

The new 50 Series Float and Thermostatic Trap has an integral thermostatic air by-pass consisting of thermal element, seat, and cage, factory set and sealed assuring dependable service and easy maintenance.

The same fine Hoffman quality and precision workmanship prevails in these traps as in the other Hoffman heating specialties. The valve lever and seat assembly is constructed of durable brass stampings. The spherical float is copper clad steel. The valve pin, adjustable for positive seating, and the valve seat are made of stainless steel. Sizes are available from ¾" to 2"—pressure requirements of ½ lb. to 125 lb.

If you are planning to install low, medium or high pressure Float or Float and Thermostatic Traps on storage tank heaters, tankless heaters, converters, blast coils, or for discharging high pressure returns into low pressure steam mains of 1 or 2 pipe systems, it will pay you to ask for Hoffman's new illustrated catalog sheet, available upon request.



LOW MAINTENANCE COST

50 Series Float and Thermostatic Traps have cover construction so designed that all working parts of the trap are readily accessible. Once installed there is no necessity for the breaking of any pipe connection as all cleaning and repairing can be made by removing the cover of the trap.

HOFFMAN STEAM SPECIALTIES

HOFFMAN SPECIALTY MFG. CORP.

VALVES, TRAPS, VACUUM AND CONDENSATION PUMPS, FORCED HOT WATER HEATING

1001 York St., Indianapolis 7, Ind.

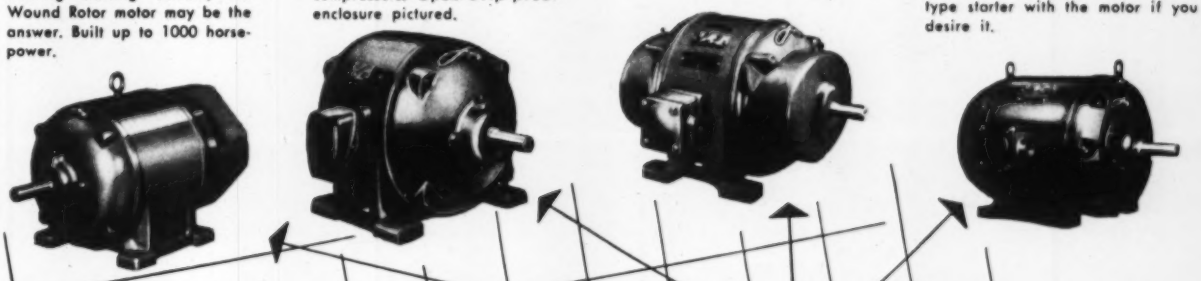
SYSTEMS Sold by leading Wholesalers of Heating and Plumbing Equipment

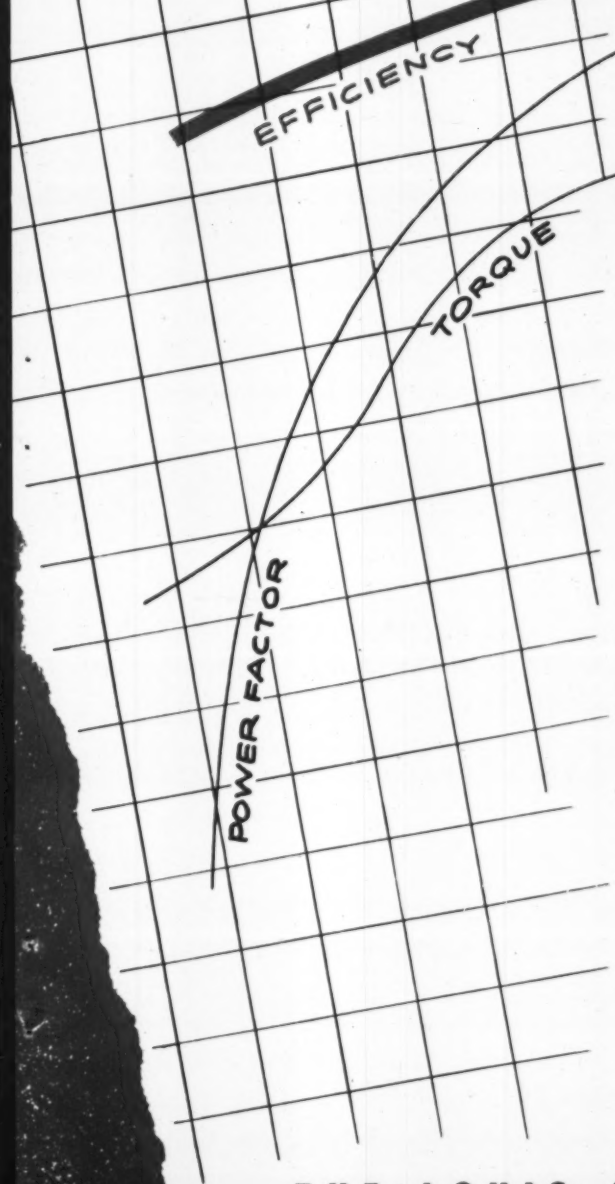
Wound Rotor motor. When you need adjustable speed over a limited range, or a means of limiting starting current, the Wound Rotor motor may be the answer. Built up to 1000 horsepower.

High torque compressor motor. Any motor enclosure that you require, in a wide range of horsepower. Special electrical characteristics for the starting torque for your loaded compressors. Open Drip-proof enclosure pictured.

Standard induction motor. Here's dependable power for your stokers, blowers, fans and other applications requiring standard squirrel cage motors. All enclosures, standard and special, with Splash-proof shown.

Part Winding motors. Part Winding or Increment Start motors for use on power circuits using automatic voltage regulators are available in all enclosures (Fan-cooled pictured) and with standard and high torque characteristics. We will be glad to supply an increment type starter with the motor if you desire it.





Get top performance

with the right motor for your heating or air conditioning job from the Louis Allis line

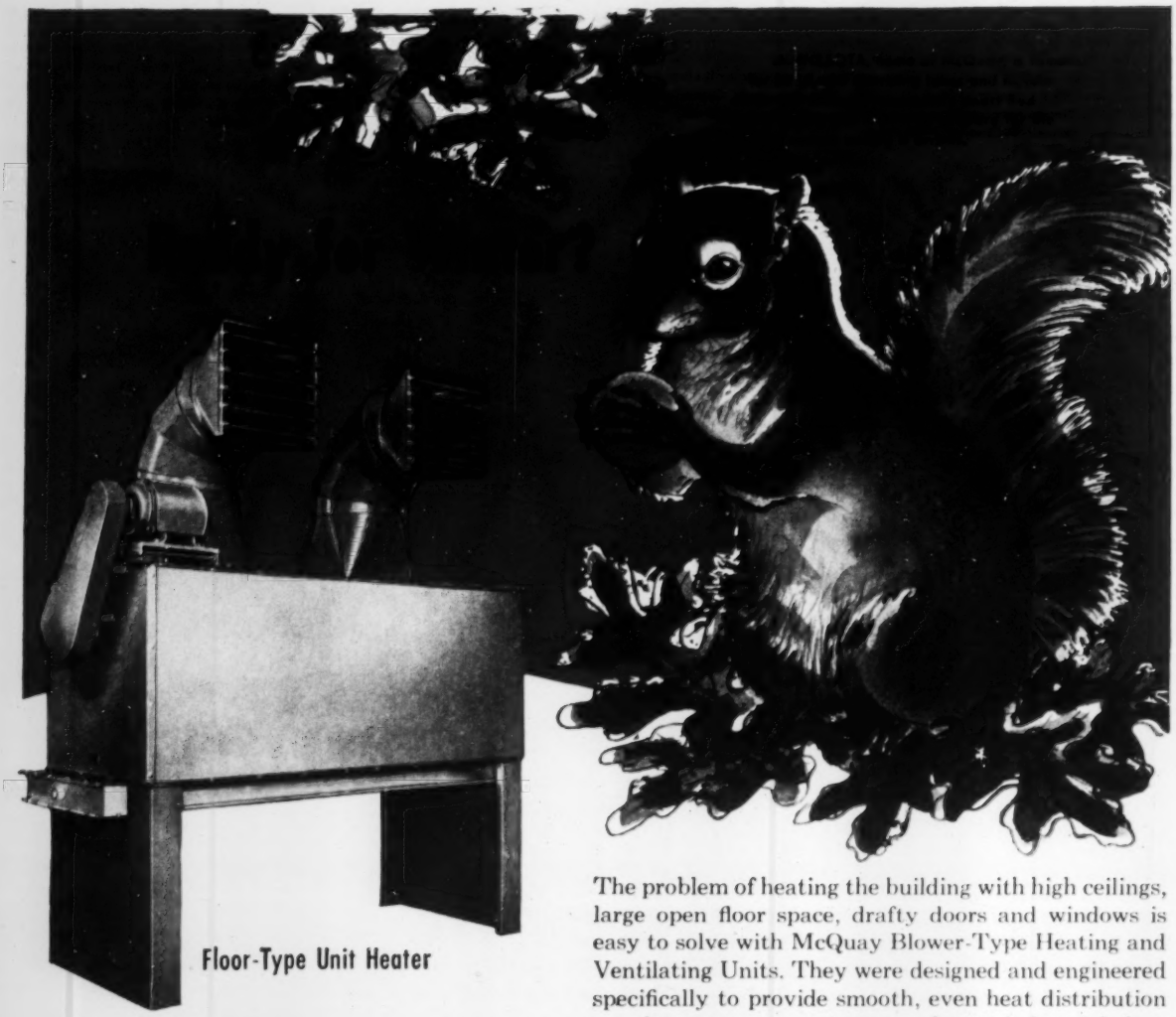
The complete Louis Allis line makes it easy to get the right motor for your heating, ventilating, and air-conditioning equipment. You don't have to settle for less than top performance — there is a Louis Allis Motor designed specifically for your job and a Field Engineer nearby, with the right answer to your motor problems.

The four motors above are only a few of the many types of Louis Allis motors that are available. We invite you to call your nearest Louis Allis Office or write to us for application or engineering assistance. We are sure that our 52 years of motor experience can be of help to you.

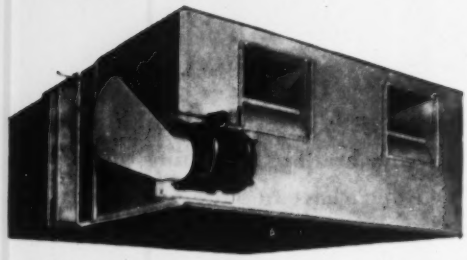
THE LOUIS ALLIS CO.

MILWAUKEE 7, WISCONSIN

V-101



Floor-Type Unit Heater



Horizontal Unit Heater

The problem of heating the building with high ceilings, large open floor space, drafty doors and windows is easy to solve with McQuay Blower-Type Heating and Ventilating Units. They were designed and engineered specifically to provide smooth, even heat distribution over large areas common to warehouse, industrial plant and garage types of building construction. Available in floor, horizontal, vertical, wall and inverted styles in 8 sizes; capacities from 20,620 to 1,632,000 Btu per hour. Basic in these versatile heaters is the famous Ripple Fin Coil with tubes hydraulically expanded into wide spun fin collars, the exclusive McQuay construction feature that assures maximum heat transfer efficiency and rugged dependability. Representatives in principal cities or write McQuay Inc., 1601 Broadway Street N.E., Minneapolis 13, Minnesota.

McQuay INC.

MAKE THE SEASONS COME TO YOU

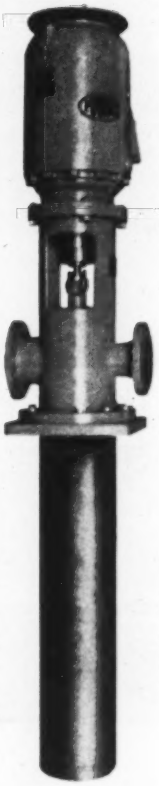
AIR CONDITIONING • REFRIGERATION HEATING

FOR *ALL* *your* **PUMPING problems:**

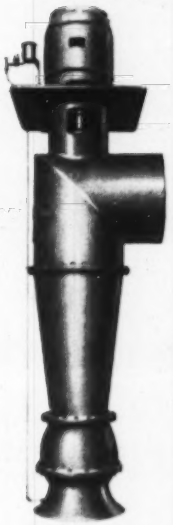
- HOT OR COLD WATER CIRCULATING
- LOW PRESSURE WATER HANDLING
- HIGH PRESSURE PUMPING
- BOOSTER PRESSURE SYSTEMS
- WATER SUPPLY AND TRANSFER
- LARGE VOLUME LOW HEAD PUMPING
- CHEMICAL PROCESS SERVICE PUMPS

YOU CAN DO A BETTER JOB with these *Dependable* PEERLESS PUMPS

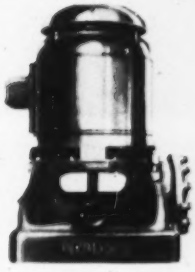
VERTICAL HORIZONTAL



VERTICAL ENCASED CENTRIFUGAL PUMP—The Peerless "Hydro-Line." For heavy duty condensate return service. Rugged, dependable, versatile, vertical design.

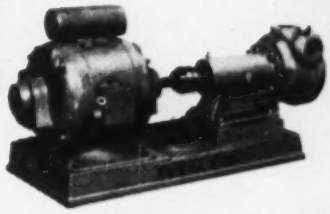


MIXED FLOW AND PROPELLER PUMPS—Giants in the world of pumping. For high capacities, low head. Single and multi-stage types for all water services. Also widely applied to flood control and drainage pumping. Capacities to 220,000 gpm.

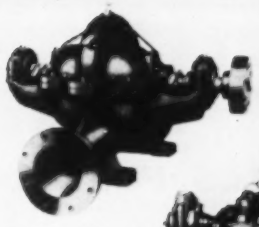


VERTICAL TURBINE TYPE PUMPS—Electric and engine driven pumps for primary water supply from deep or shallow drilled wells. America's sales leader. All sizes, capacities and hp.

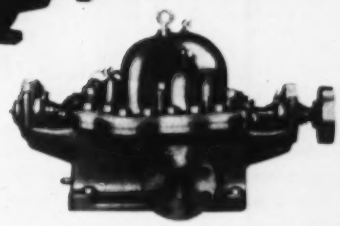
END SUCTION PUMPS—The Peerless "Fluidyne" line. Economical face mount and flexible coupled pumps for widest variety of water handling services. ¼ to 150 hp available. Efficient, easily serviced.



TURBINE VANE TYPE PUMPS—For pumping hot or cold, clear or vaporous liquids. Face mount or flexible coupled types. Standard and self-priming models for pumping small capacities, high heads.



TYPE A—ALL PURPOSE WATER PUMP—Single stage double suction split case type pumps. Broad line, up to 70,000 gpm capacity. All types of drive; quality construction.



TYPE TU—MULTI-STAGE PUMP—For high pressure pumping. 2, 3, 4 and 5-stage pumps available. Horizontal split case design. For capacities up to 3500 gpm; heads to 1600 feet.

PEERLESS PUMPS

fmc FOOD MACHINERY AND CHEMICAL CORPORATION

PEERLESS PUMP DIVISION

FOOD MACHINERY AND CHEMICAL CORPORATION

Factories: Los Angeles, Calif. and Indianapolis, Indiana.
Offices: New York; Atlanta; Chicago; St. Louis; Indianapolis; Phoenix; Fresno; Los Angeles; Tulsa; Dallas, Plainview, and Lubbock, Texas; Albuquerque, New Mexico.
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Mail Coupon TODAY!

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
301 West Avenue 26, Los Angeles 31, California

CHECK BULLETINS YOU REQUIRE

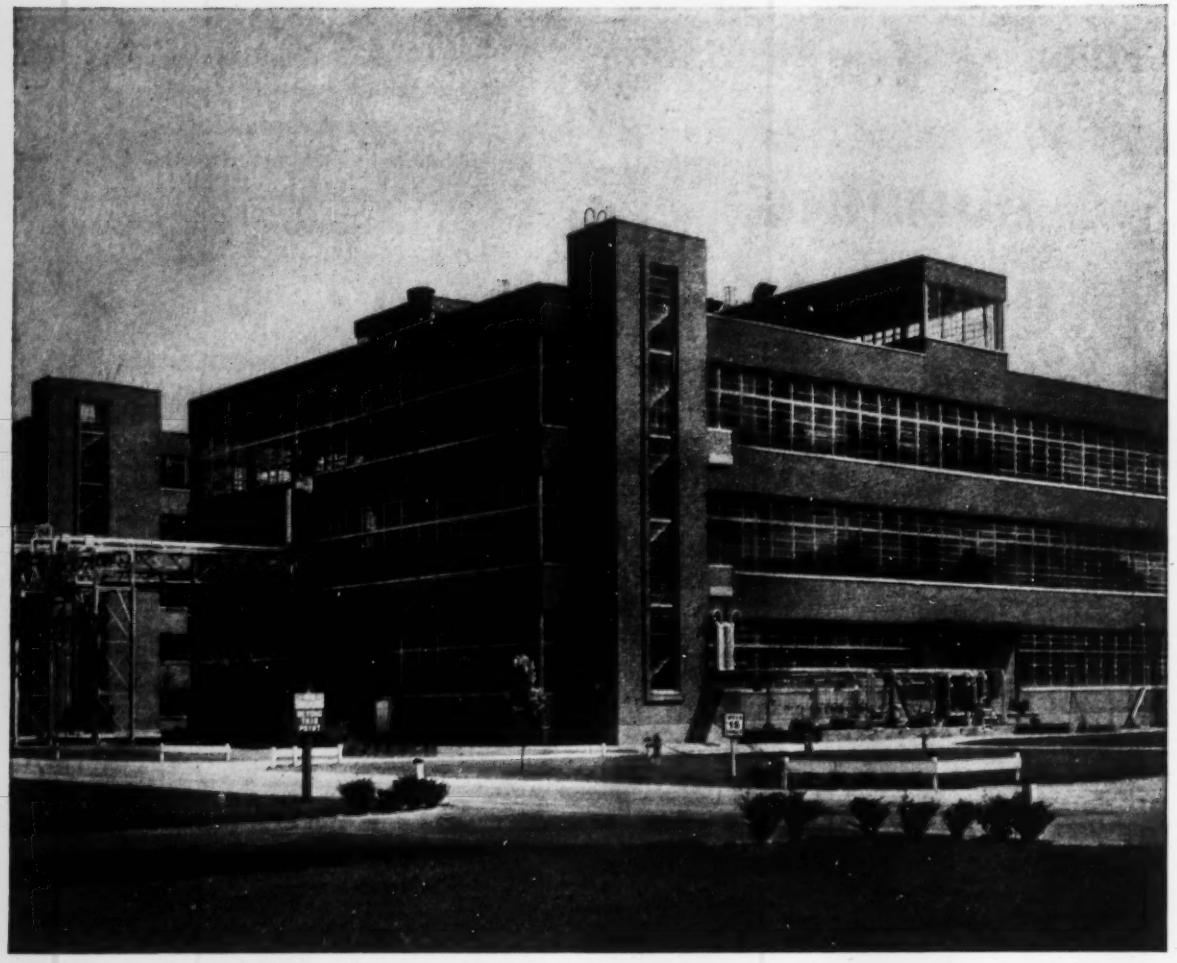
- ☐ TURBINE VANE PUMPS Bulletin # 2205
- ☐ VERTICAL ENCASED HYDROLINE PUMP Bulletin # 592
- ☐ MULTI-STAGE PUMPS Bulletin # 1400
- ☐ FLUIDYNE END SUCTION PUMPS Bulletin # 2300
- ☐ TYPE A ALL PURPOSE PUMP Bulletin # 1300
- ☐ WATER SUPPLY PUMPS Bulletin # 141

NAME_____

COMPANY_____

STREET_____

CITY_____ STATE_____



Wind and sun load don't affect working conditions here.

UNIT HEATING
SAVES FUEL COST

How do you economically heat a plant where the walls have more glass area than brick? That can be a real problem. Constantly changing wind and sun loads cause a central-plant system to overheat and underheat.

But the Tom's River Division of CIBA STATES LIMITED found the answer with unit heaters. They installed 200 Westinghouse Speedheaters throughout their three large buildings. The Speedheaters supply heat only as required. For CIBA: acres of sunlit workspace, winter comfort control, economical heating with low investment.

Are you building new quarters? Are your heating costs high? You'll save money with Westinghouse Speedheaters. Install them today. Write for Catalogs 1521 and 1525. Westinghouse Air Conditioning Division, Hyde Park 36, Massachusetts.

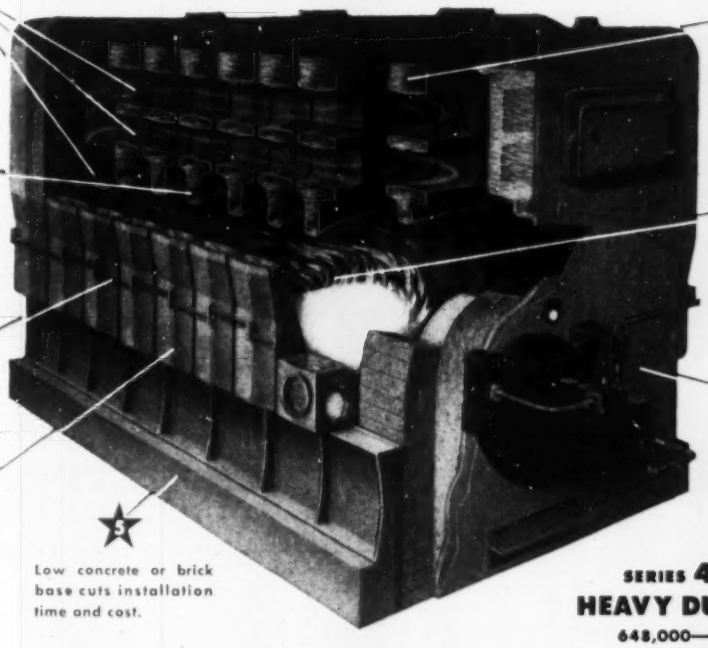
Westinghouse Speedheaters blanket large window areas. Separate control for each area provides the most efficient heating. Fan-driven air results in uniform temperatures throughout.

WESTINGHOUSE SPEEDHEATERS

YOU CAN BE SURE... IF IT'S **Westinghouse**

J-80339

NOW DESIGNED FOR HORIZONTAL ROTARY BURNERS

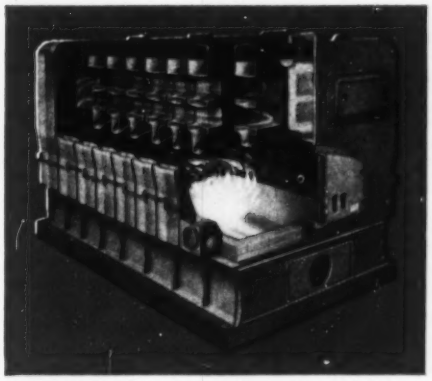


1. Balanced fire travel assures equal distribution of heat to all vital heating surfaces.
2. Curved extra primary heating surface extends from crownsheet to greatly increase area directly above the fire.
3. Individual short tie-rods for easier assembly and longer boiler life.
4. Rugged cast iron construction for durability and trouble-free performance.
5. Low concrete or brick base cuts installation time and cost.
6. Large waterways permit quick, efficient water circulation through boiler.
7. Large primary combustion area for better burning conditions and maximum heat release from fuel.
8. Special steel front plate and section provides for easy installation of rotary burner.

SERIES 40 AND 44
HEAVY DUTY BOILERS
648,000—2,712,000 BTU

WEIL-McLAIN

IT IS MORE PROFITABLE TO SELL *EXTRA VALUE*



The standard Series 40 and 44 Boiler
These heavy duty boilers have built an enviable reputation for economy and service-free operation in schools, commercial and industrial buildings. Wide range of capacities—easily converted from one fuel to another.

Weil-McLain presents an important new development in its Series 40 and 44 Boilers. Special features have been added to these heavy duty boilers which adapt them for operation with the leading makes of horizontal rotary oil burners.

Series 40 and 44 Boilers provide a highly efficient installation when fired with heavy oils. A large primary combustion area and a fire travel through flueways designed to provide complete utilization of secondary heating surfaces are important reasons for the economical operation of these boilers.

SPECIAL STEEL FRONT PLATE AND SECTION
for simplified Rotary Burner installation

Furnished as standard equipment is a specially designed steel front plate. The size and location of the various openings in this plate are in accordance with the specifications of the rotary burner to be installed. The plate is bolted to the front section of the boiler, permitting easy attachment of the burner!

EASIER, FASTER ERECTION

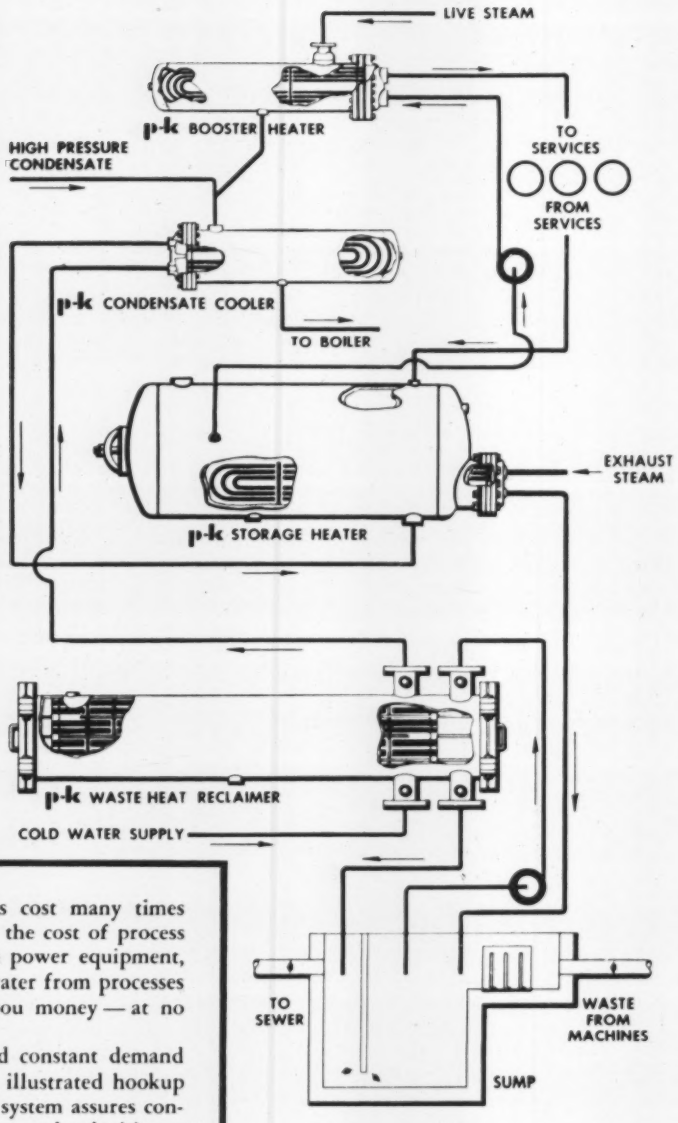
Series 40 and 44 Boilers are assembled with individual short tie-rods, which permit rapid erection without special equipment. Sectional construction makes it easy to add capacity, should future additional heating loads require it. In existing buildings, Series 40 and 44 Boilers can be installed without structural alterations.

Full information is given in Bulletin C-137 . . . send for your copy.

WEIL-McLAIN
BOILERS · RADIATORS

WEIL-McLAIN COMPANY
MICHIGAN CITY, INDIANA

how to exchange heat and save half your fuel dollar



p-k hot water supply system — one of numerous variations — for maximum heat recovery in processes using large quantities of hot water.

Whether your operation is in the textile, chemical, laundry, pulp and paper fields, or any field where hot water is required, **p-k** can recommend the proper recovery system for optimum heat balance.

p-k equipment can earn its cost many times over, save 50% and more of the cost of process heating. Exhaust steam from power equipment, or condensate or waste hot water from processes — can go to work saving you money — at no added operating cost.

When there is a large and constant demand for hot process water, **p-k**'s illustrated hookup No. 1 is recommended. This system assures control of temperatures, pressures and velocities at all plant stations. Substantial increases in production can be made without additional equipment.

p-k reclaimers, storage heaters, condensate coolers, booster heaters, etc. are available in many standard sizes and types to meet most industrial or commercial requirements.

Learn more about the sure savings available to you — write now for complete information. Ask for Cat. No. 310. Further information and engineering assistance will be gladly provided without obligation.

the Patterson-Kelley Co., inc.

810 Burson St. East Stroudsburg, Penn.

1918

101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities

Modern Baseboard Heating at its BEST!
NEW!
VULCAN
TRIMLINE
RADI-VECTOR
(RESIDENTIAL)
VULCAN

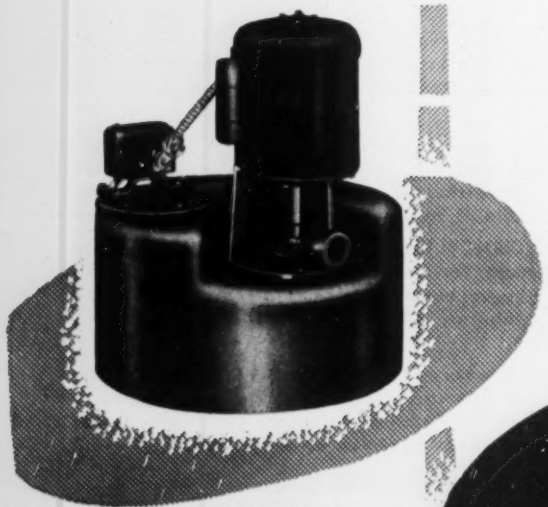
latest contribution

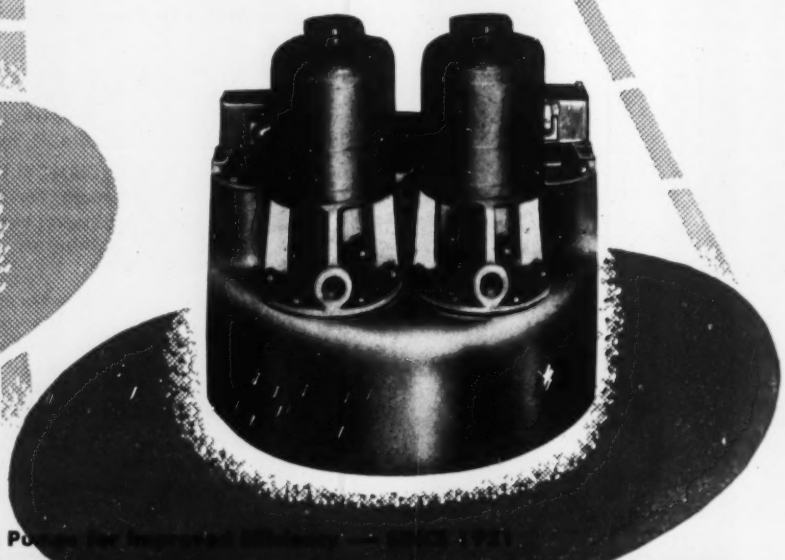
MAINTAINED SKIDMORE PUMPS EFFICIENCY

THE NEW "CV" DUPLEX UNIT --- TAKES THE SPOTLIGHT!

A worthy complement to the popular "CV" single unit and a fine addition to the Skidmore family. Equipped with either individual float switches or automatic alternating float switch, the new Skidmore Duplex Unit now provides a simple positive means of alternating the operation of two pumps installed on a duplex unit with a common receiver, and insures even wear of the pumping unit. The Duplex Unit incorporates all the desirable features of the single unit. Compact and dependable, the unit requires a minimum of space and offers wide range of selectivity . . . this adds up to low installation cost and long trouble-free service. Pump is bronze fitted with enclosed centrifugal impeller, stainless steel shaft, self lubricating bronze bearing and low return connection.

Left—Type "CV" Single Unit
Right—Type "CV" Duplex Unit





WRITE FOR NEW BULLETIN NO. 21-A
Contains engineering data on the Single and the Duplex Units.

Skidmore Heating Pu[illegible]

SKIDMORE CORPORATION ● ST. JOSEPH, MICHIGAN

In the Refrigeration Industry W-S Screw-End Fittings . . .

MORE ECONOMICAL ALL THE WAY DOWN THE LINE

FOR REAL ECONOMY on your next screwed fitting piping job specify Watson-Stillman the Double-diamond brand of Forged Steel Fittings.

You'll find their long, accurately cut threads, in perfect alignment, assure ease of installation.

You'll find their extra long bands extending well beyond the last thread, provide reinforcement at points of severest strain.

You'll find their heavy uniform fitting wall thickness provides a high safety factor to give you years of leak proof, trouble-free service.

Accurately machined . . . they fit tight and they're made of forging stock especially selected for toughness, strength, and resistance to temperature and shock. Available in carbon, stainless and chrome-moly alloy steels.

Watson-Stillman also makes a complete line of forged Socket-Welding fittings. Investigate these superior, life-of-the-system joints. Write for literature.

SOLD THROUGH LEADING DISTRIBUTORS

WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

132 ALDENE RD., ROSELLE, NEW JERSEY

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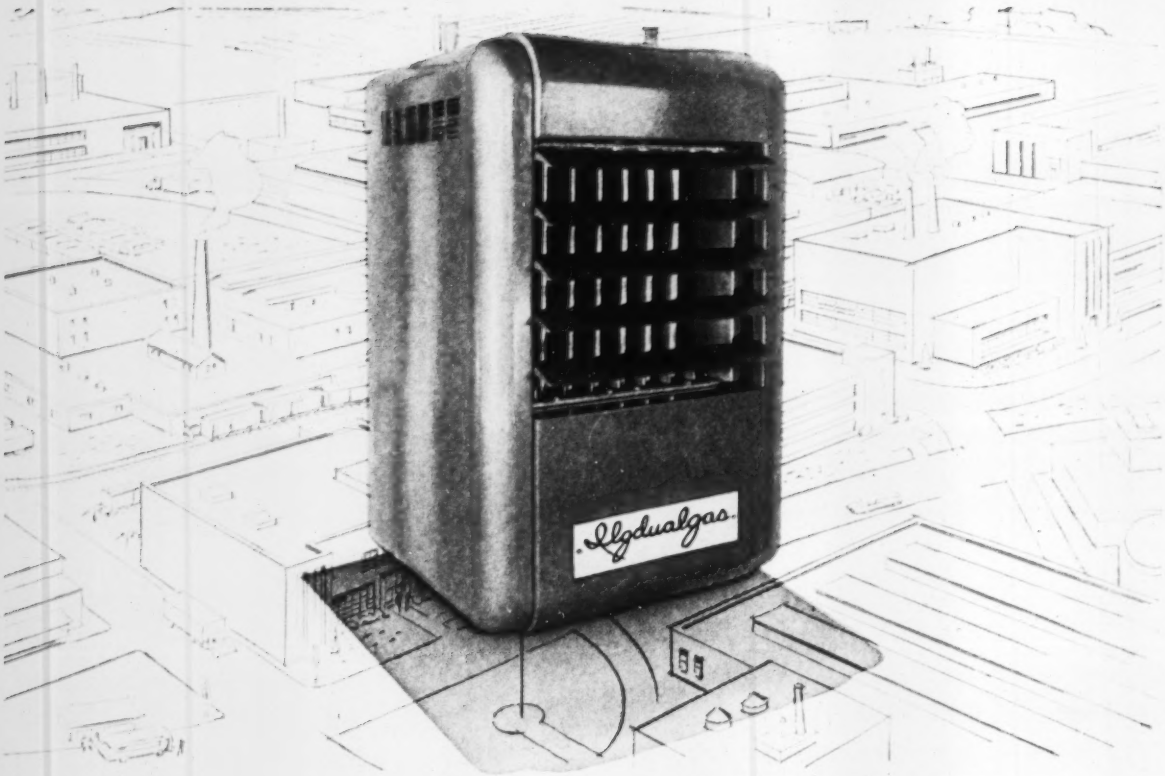


Introducing the new ILGDUALGAS !

Ilg's complete new line of gas fired unit heaters — at an attractive price

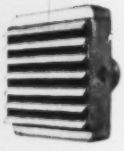
Today's big news is the new ILGDUALGAS–it's everything you want in a gas fired unit heater. Completely self contained, the new Ilgdualgas offers fully automatic controlled heating–uses natural, manufactured, mixed, propane or butane gas, and comes in a wide range of heat capacities from 25,000 to 200,000 BTU's. Suspended, propeller fan type, it's quick and easy to put up . . . smooth running, quiet. Initial cost is low and so is upkeep, with service kept to a minimum. Ilgdualgas has simplified central control system with both manual and automatic safety devices and is approved by Underwriters' Laboratories and The American Gas Association.

Now you can have Ilg's top quality in every type of unit heater, either steam, hot water, electric or . . . *gas,* to help you meet practically any space heating requirement for commercial or industrial installations.

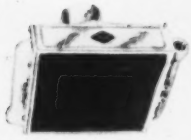
Free... Bulletin 285 gives complete information ratings, specifications on new Ilgdualgas. Write for your copy today!

ILG ELECTRIC VENTILATING CO.
2850 North Pulaski Road Chicago 41, Illinois

ILG



Ilg steam unit heater—horizontal type.



Ilg steam unit heater—vertical type.

Ilg electric unit heater—horizontal type.

when cost competition is tough, you can make "DIVIDENDS UNLIMITED" with Ramset Fastening System for anchoring into steel or concrete

With tighter competition for every job, super-speed RAMSET SYSTEM offers one sure way of cutting installation time and expense. You can figure the lowest "fastener-in-place" cost to help you get more business, at a profit.

For most work, nothing tops the new PLUS-POWER JOBMASTER, with two quickly interchangeable barrels, for ¼" or ⅜" fasteners. You save ⅓ on powder loads because it uses light-duty loads for many medium and heavy-duty jobs.

Tru-Set Fasteners, in 6 types and 60 sizes, give widest choice and utility. Exclusive Red-Tip Pilots and adjustable Roto-Set Shield guide them straight to the work with hair-line accuracy, for still greater economy without waste.

Whether your work calls for ¼", ⅜" or ½" fastenings, RAMSET SYSTEM aids you to out-quote competition, and pays "DIVIDENDS UNLIMITED" on a very small investment.

Ask your dealer to help you cut costs with RAMSET and give you an on-your-job demonstration and proof. Or, mail the coupon.

Pioneer and Leader in powder-actuated fastening. Preferred by users 2-to-1 over all other makes combined. For six years, RAMSET SYSTEM has paid "DIVIDENDS UNLIMITED" to thousands of users because of ease, speed, economy and utility.

Ramset Fasteners, INC. ANOTHER Olin PRODUCT

Ramset Division, Olin Industries, Inc.

12109 BEREA ROAD • CLEVELAND 11, OHIO

Please show us how we can collect "Dividends Unlimited" with RAMSET SYSTEM for steel and concrete fastenings.

Name_____

Company_____

Address_____

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HP-11

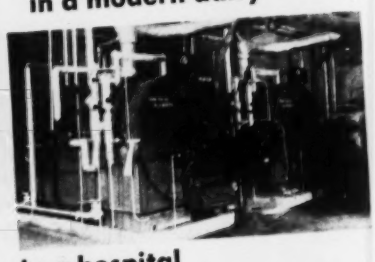
Dutton EconoTHERM EARNS OWNER PRAISE

in a railroad roundhouse

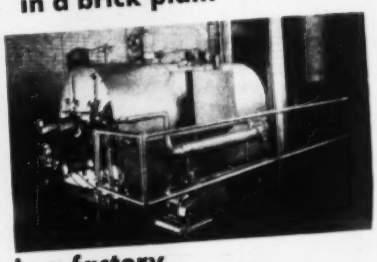
in a modern dairy

in a brick plant

in a food processing plant

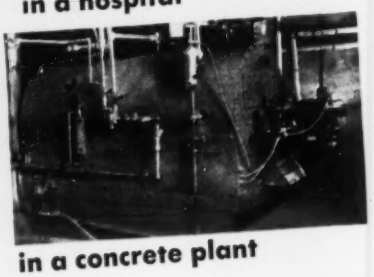


in a hospital

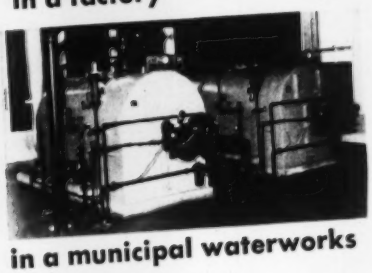


in a factory

in an institution



in a concrete plant



in a municipal waterworks

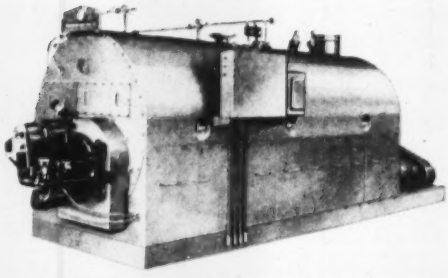
AND HERE'S WHY!

Verbally and by mail* owners have enthusiastically reported big savings in fuel, labor and space — often all three — thanks to EconoTHERM's efficient Off-center Firing, Rotary Combustion and Automatic Operation.

EconoTHERM gives quick steam with greater safety . . . saves fuel, labor and maintenance expense. Gas or oil fired, sizes are available to 250 H.P.

Get all the facts on the Dutton EconoTHERM's compact, modern packaged design and automatic operating features. See how it can satisfy your steam needs and save *you* money!

*Ask to see the letters!



Write for EconoTherm Bulletin EC-52G

Dutton BOILERS

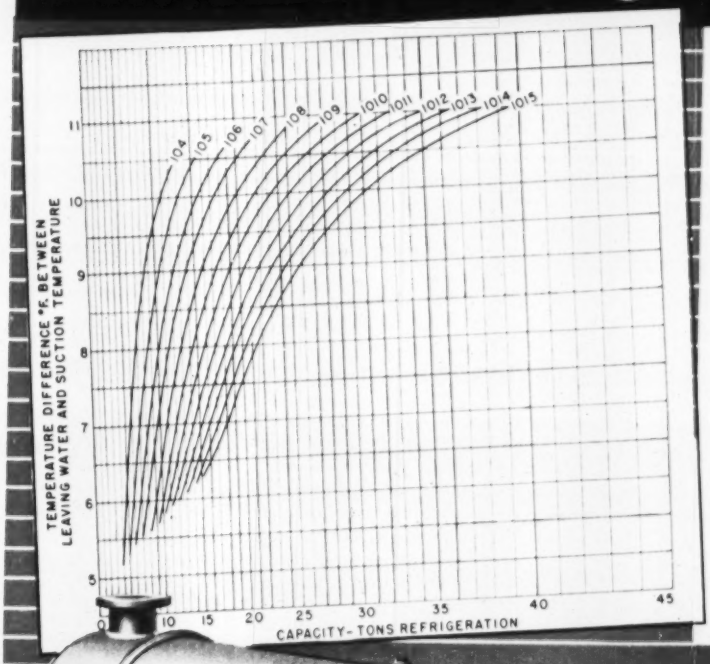
CHECK FIRST with Dutton

DIVISION HAPMAN-DUTTON COMPANY

KALAMAZOO, MICHIGAN • BOILER BUILDERS SINCE 1880

FOUR TYPES — SIZES FROM 5 to 250 h.p.

HOW TO SELECT AN EVAPORATOR *the Easy Way*



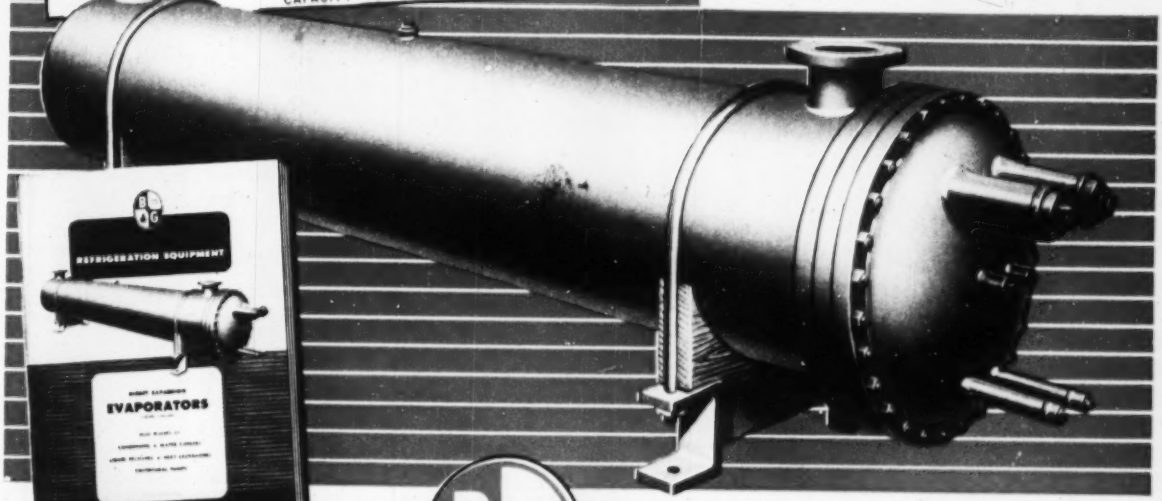
Send for new B & G Evaporator Catalog with simplified engineering and selection data

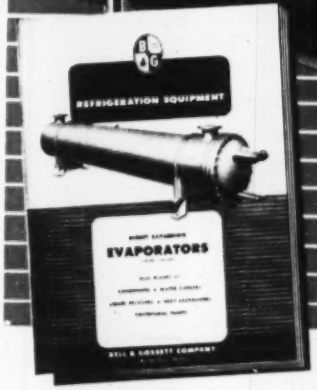
The chart shown here illustrates one of the ways in which B & G has made evaporator selection a simple matter. Most calculations are translated into chart form—shortening designing time.

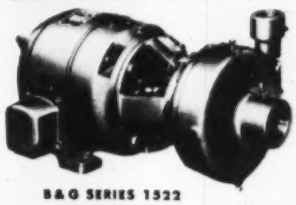
The B & G Series "HR" Evaporator offers distinctive features which mean more efficient and dependable performance. The construction, for example, which prevents oil-trapping in the head passes and assures uninterrupted oil and vapor flow.

Easier to install and insulate

Removable steel legs are adjustable to meet various mounting conditions. A heavy hardwood block is furnished for insertion between the shell and support legs—making the unit easier to insulate and preventing damage from condensation. Shell connections extend well beyond the insulation cover—a great convenience when installing.







B&G SERIES 1522 CENTRIFUGAL PUMP

Eight big design features—ideal for cooling tower and evaporative condenser installations.

Ask also for catalogs on B & G *Hydro-Flo* Condensers, Heat Exchangers and Centrifugal Pumps.

Hydro-Flo®

REFRIGERATION EQUIPMENT

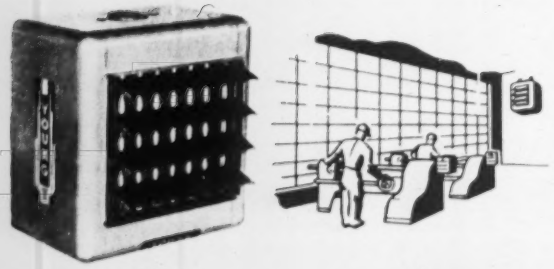
BELL & GOSSETT COMPANY

Dept. RDE-5, Morton Grove, Ill.

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada

*Reg. U. S. Pat. Off.

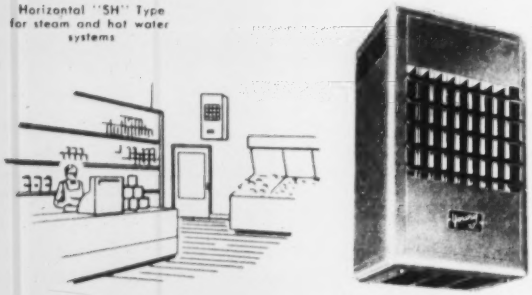
These Young Unit Heaters are Heating "Specialists"!



Horizontal "SH" Type for steam and hot water systems

FOR GENERAL PURPOSE REQUIREMENTS

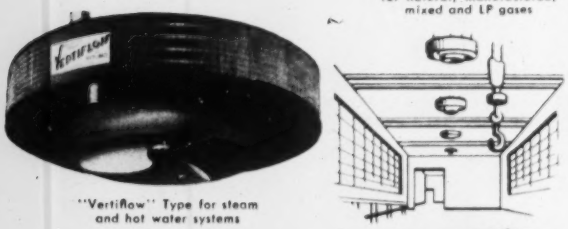
Here's an all-purpose unit for most general heating requirements . . . Young "SH" Type horizontal Unit Heater, available in fourteen models, for use with steam and hot water systems. Heavy-duty casings are made of braced and welded furniture steel with rounded corners, durable baked-on gray enamel finish, and individually adjustable louvers. Features include quiet, rubber-mounted motor, spring-suspended mechanically bonded tube-and-fin heating element, plus 15 other design advantages.



Horizontal Gas-Fired Type for natural, manufactured, mixed and LP gases

Young Gas-Fired Units, with horizontal delivery, are especially suited for installations not requiring a boiler. Available in eight physical sizes these units feature aluminized steel construction. Molten aluminum is permanently bonded to steel base metal in both combustion chambers and heat exchanger, to withstand the corrosive effects of gases and high temperatures. Approved by the AGA for use with either natural, manufactured, mixed and LP gases.

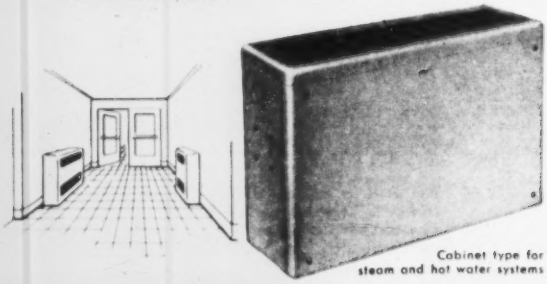
FOR DELIVERING HEAT FROM HIGH CEILINGS



"Vertiflow" Type for steam and hot water systems

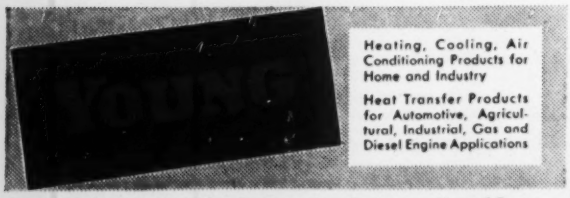
Where direct, downward distribution of heated air is desired . . . above craneways and other high-ceiling installations . . . Young "Vertiflow" Unit Heaters should be specified. Seven models, for use with steam and hot water, may be equipped with several types of adjustable diffusers and Anemostats for various heating patterns. Exclusive ventilating stack surrounds motor with cooler room air, prevents failure due to overheating. Features quiet operation, mechanically bonded tube-and-fin heating element, etc.

FOR WARMING COLD SPOTS WHERE APPEARANCE IS IMPORTANT



Cabinet type for steam and hot water systems

Lobbies, vestibules and similar installations require unit heater performance, plus an attractive appearance. For these Young offers Cabinet Units with three sizes in each of three cabinet styles for use with steam and hot water systems. With accessories, these units may be wall-hung, inverted wall-hung, ceiling mounted, free-standing, with ducts, inlet grilles, etc. Features quiet operating blower assembly with entire unit designed for ease of installation.



Heating, Cooling, Air Conditioning Products for Home and Industry

Heat Transfer Products for Automotive, Agricultural, Industrial, Gas and Diesel Engine Applications

Leaders in Heat Transfer Engineering for more than 25 years

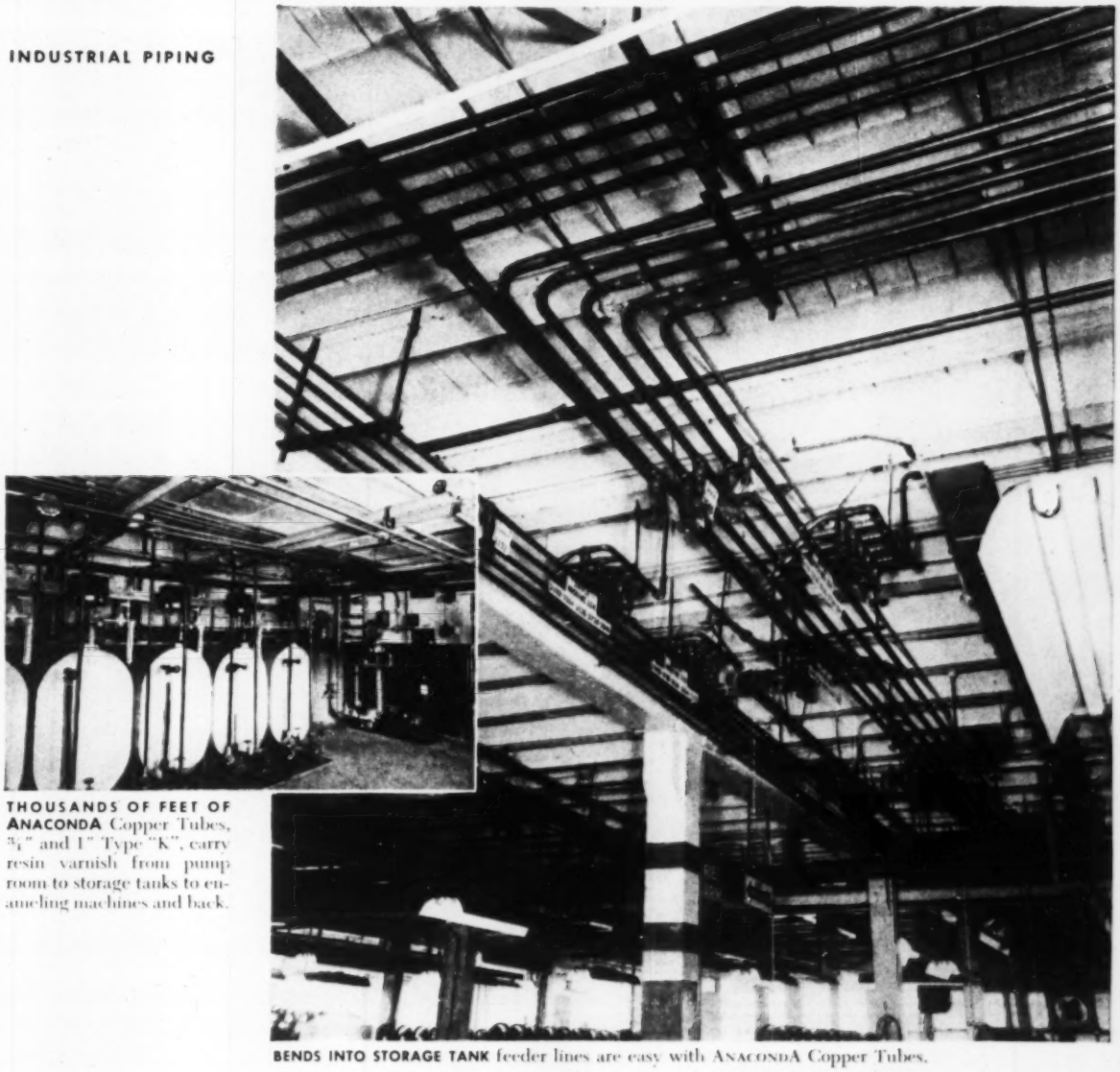
For further information, including ratings, dimensions, construction features, etc., see your nearest Young Representative or write for free catalogs.

YOUNG RADIATOR COMPANY

Dept. 513-L • Racine, Wisconsin

Plants at Racine, Wisconsin and Mattoon, Illinois

Sales and Engineering Representatives in All Principal Cities



THOUSANDS OF FEET OF ANACONDA Copper Tubes, ¾" and 1" Type "K", carry resin varnish from pump room to storage tanks to enameling machines and back.

BENDS INTO STORAGE TANK feeder lines are easy with ANACONDA Copper Tubes.

THIS VARNISH-DISTRIBUTING SYSTEM STAYS CLEAN

It's copper . . . and a five-year check-up reveals no contamination

Resin varnish, kept constantly at 90 to 100°F to maintain low viscosity, has been pumped through these ANACONDA Copper Tubes for 5 years. The plant engineer of this leading wire manufacturer doesn't plan his next check-up for at least two more years. There have been no leaks . . . no shutdowns due to clogging. Periodic check-ups show no varnish contamination and, of course, with copper tubes there is no rust formation. Varnish flow is as steady today as when the piping was first used.

Pipelines of copper are economy pipe lines. Lightweight, available in long lengths and easily bent to by-pass obstructions, copper tubes permit inexpensive, speedy installations. The smooth bore of both copper tubes and wrought solder-type fittings means less flow resistance. Result: low pumping costs. Easy dismantling and high salvage value spell possible future savings, too, should plant layout be changed.

Publication C-24 offers many additional facts on how ANACONDA Copper Tubes can help improve product quality, reduce operating and maintenance costs and avoid costly shutdowns. Write to: *The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

5487

call your

ANACONDA®

distributor for

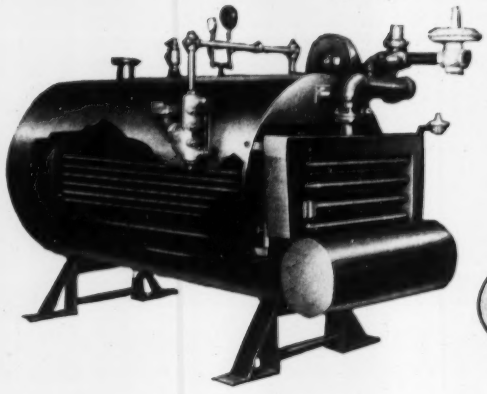
Copper tubes and fittings for industrial process lines, water, heating and sanitary drainage systems • American Flexible Metal Hose and Tubing • American Vibration Eliminators.

All three know..

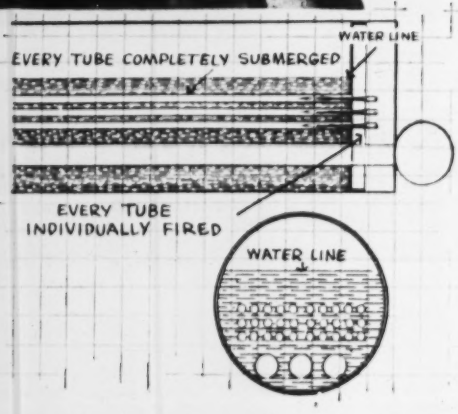
ENGINEER

ARCHITECT

CONTRACTOR



THAT NO OTHER STEAM BOILER IS LIKE A SELLERS IMMERSION STEAM BOILER!



Anyone familiar or experienced in steam boiler installations knows that a Sellers Immersion Steam Boiler is different because of its *REMARKABLE* and *SIMPLE DESIGN*. Each of the many long tubes are *individually gas fired*—and therefore *uniformly heated*. Furthermore, these tubes are completely submerged and nearer the water level—for 100% water backing and increased heating efficiency.

Many other features of this Sellers design combine to give you years of maximum efficiency at remarkably low operating costs. Twelve sizes available!

SEND FOR BULLETIN 1206 C-00
Your letterhead will bring you this tell all, dollar saving story on all 12 sizes!

Sellers ENGINEERING CO.

4876 N. CLARK STREET CHICAGO, ILL.

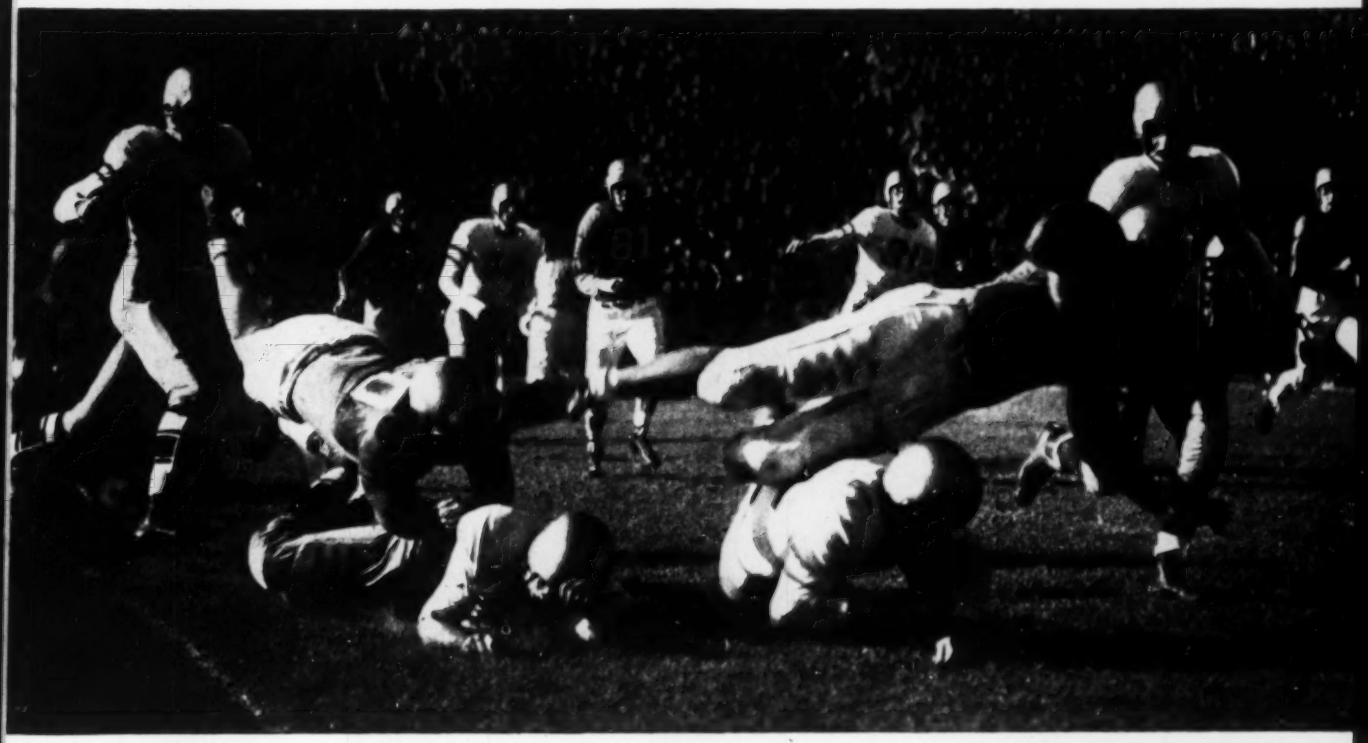
Blast Heaters • Immersion Automatic Water Heaters • Combustion Units • Industrial Gas Burners
Vertical Steam Boilers • Immersion Tank Heaters • Immersion Steam Boilers

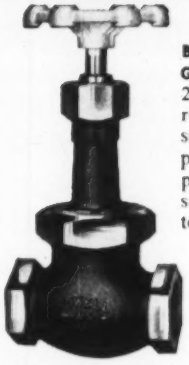
STAR PERFORMERS

From coast to coast, Powell Valves have won enthusiastic approval. For *every* Powell Valve is a *star for outstanding performance*. They have a record of dependability since 1846.

Small wonder that Powell Valves have made such a hit through the years. Powell has probably done more valve research, solved more valve problems and makes more types of valves than any other organization in the world.

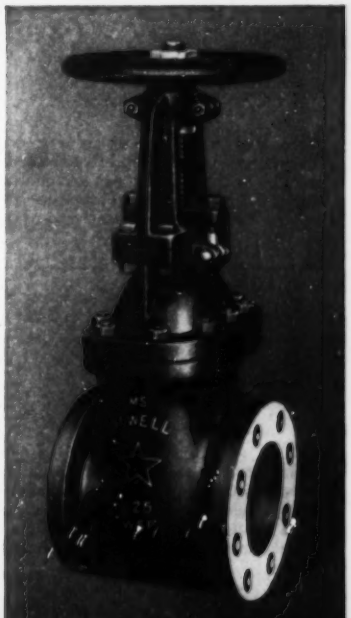
We're sure that *you* will be enthusiastic about Powell Valves too once you see how they perform. Following are just a few members of the Powell all-star cast of valves which are available through distributors in principal cities. If a distributor is not located near you, just write us. We'll be pleased to tell you more about these valves—and our complete line.





BRONZE "W.S." FULL FLOW GLOBE VALVE *(Fig. 2608)* for 200 pounds W.P. Regrindable, renewable, hardened stainless steel seat and disc. Nominal pipe size opening through seat permits fuller flow, with pressure drop and turbulence cut to minimum.

"MODEL STAR" GATE VALVE *(Fig. 1793)* for 125 pounds W.P. Iron body, bronze mounted. Supplied with taper solid wedge. Sizes 2" to 30", inclusive.



CAST STEEL SWING CHECK VALVE *(Fig. 1561)* 150 pounds. Bolted flanged cap. Heavy rugged construction. Available in sizes ¾" to 18", inclusive.

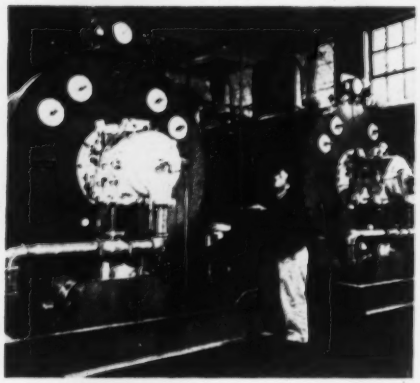
BRONZE "WHITE STAR" GATE VALVE *(Fig. 375)* for 200 pounds W.S.P. Union bonnet with inside screw rising stem. Renewable "Powellium" Nickel-Bronze wedge.

DEPENDABLE VALVES SINCE 1846

Powell Valves

THE WM. POWELL COMPANY • CINCINNATI 22, OHIO

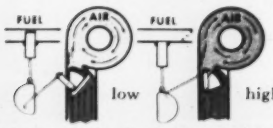
9 REASONS WHY STEAM COSTS GO DOWN



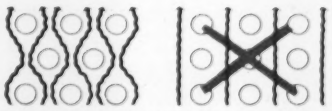
Completely Automatic Operation—Full complement of finest up-to-date operating and safety controls provides maximum operating dependability and protection with least possible attention from operator.

.....where *Powermasters* go in ...

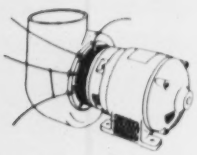
3-Pass Boiler with successive parallel paths and single gas flow reversal at each end assures most efficient flue gas velocity and heat transfer, provides maximum maintenance convenience, and requires no complex front end baffling.



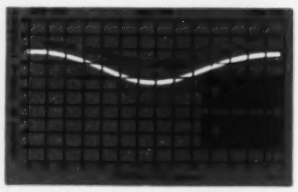
Infinitely Variable Combustion Modulation automatically maintains proper fuel-air ratio for most efficient firing at all loads. Instant response to load swings between 20% to 100% of firing rate saves fuel and assures constant steam pressure and temperature.



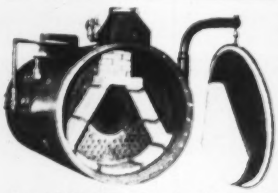
Staggered Tubes—Freedom from ineffectual boiler water eddies assures quicker heating, faster steaming, and high quality dry steam. Scrubbing action of rising water prevents corrosive gas deposits on tube surfaces.



Forced Draft provides most accurate control of combustion air supply; permits use of smaller, low-cost stack, fan and motor; requires less fan maintenance because no hot products of combustion pass through the fan.



83% Guaranteed Minimum Efficiency with No. 6 oil. At less than full load, *Powermaster efficiency* actually increases! ASME field tests prove *Powermaster's* superior performance.



Easy Accessibility for tube cleaning and inspection is provided by swinging rear cover, and divided front cover that is readily removable without disturbing burner or accessories. Convenient handholes facilitate waterside inspection.

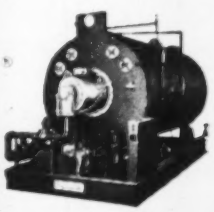
Variflow Burners keep fuel costs low and boiler efficiency high at all loads. Air-atomizing oil burner (left) and pre-mix gas burner (right)—designed by O&S expressly for *Powermaster*—provide complete, clean combustion over full firing range. Simple, sturdy construction with no moving parts, absence of vibration, and ease of cleaning minimize maintenance. Combination burner allows quick change from one fuel to another.

Compare *Powermaster*, feature by feature, with any other package boiler and you'll readily understand why it is so widely used in industrial plants, dairies, hospitals, laundries, schools, public buildings, housing projects, institutions, and many other applications . . . and adding new users at a rapid rate.

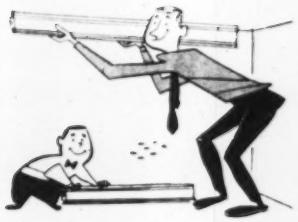
Send for this NEW BULLETIN

Describes and illustrates all cost-saving features of the modern, completely assembled, and factory fire-tested *Powermaster*. Ask for Bulletin 1219 on your company letterhead, stating your steam requirements and operating conditions.

Powermaster
PACKAGED AUTOMATIC BOILERS
In sizes to 500 HP, pressures to 250 psi.

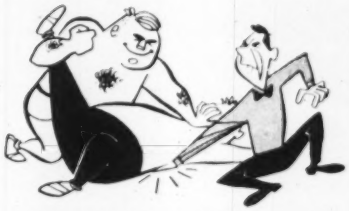


ORR & SEMBOWER, INC. • Established 1885 • **990 Morgantown Rd., Reading, Penna.**

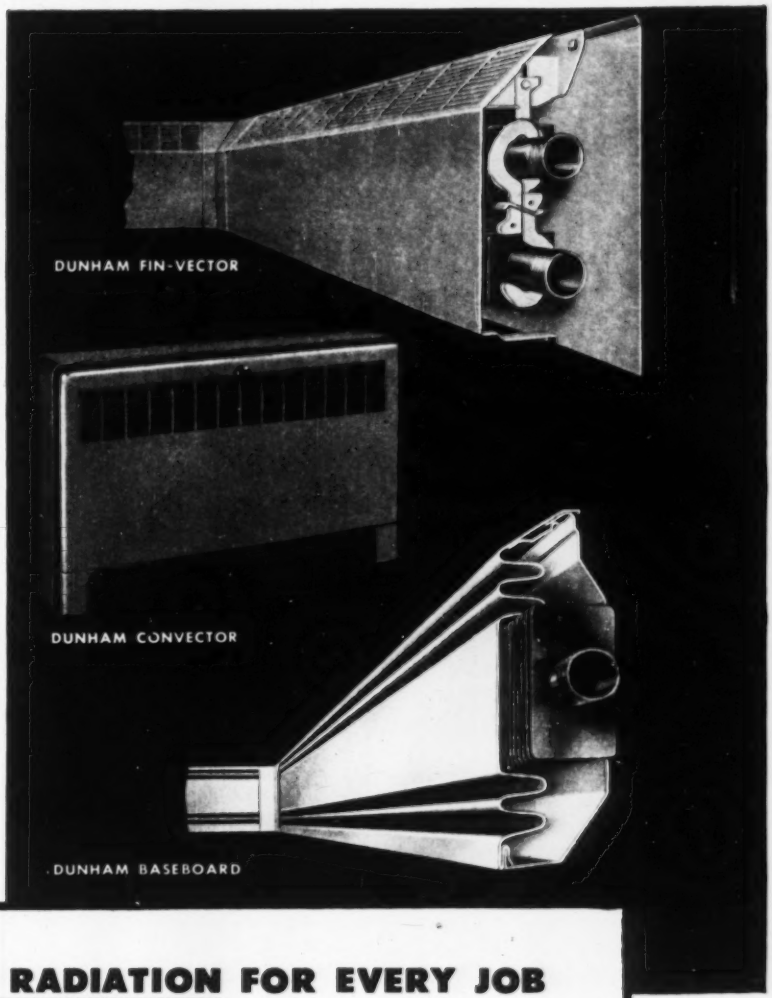


"Light weight—can be suspended at *any level* along wall"

"Easy-to-turn damper knob in reinforced, one-piece front"



"Fits flush with the floor—no 'cleaning under' problem"



EVERYTHING IN RADIATION FOR EVERY JOB ...FROM THE COMPLETE DUNHAM LINE

Here's As Complete A Line of radiation as you can get . . . *anywhere.* Good-looking Dunham Baseboard, along the wall Fin-Vector Radiation, and fast-heating Convectors have both new and improved features that can save you time and trouble now, and insure customer satisfaction years from now.

So why bother to shop around getting one type of radiation here . . . another type there? Why not put all responsibility for heating performance squarely up to one manufacturer. Let Dunham do it . . . and you'll have no regrets whether you specify, install or live with Dunham Radiation.

For complete information . . . about this complete line . . . just clip and mail the coupon.

DUNHAM HEATING EQUIPMENT

RADIATION • UNIT HEATERS • PUMPS • SPECIALTIES

QUALITY FIRST FOR FIFTY YEARS

C. A. DUNHAM COMPANY • CHICAGO • TORONTO • LONDON

C. A. DUNHAM COMPANY
Dept. HPAC-11, 400 W. Madison St.
Chicago 6, Illinois

Send literature on ☐ Baseboard ☐ Fin-Vector ☐ Convectors

Name

Firm

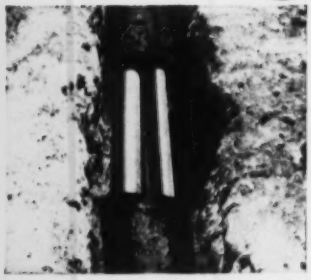
Address

City Zone State

FROM A MINE IN UTAH:

THE DISCOVERY that practices and the cost

GILSULATE*...the triple-zone insulation



GILSULATE forms its own massive circular sheath after backfill and normal introduction of heat (up to 520° F.) through pipes.

hot underground pipes. It's water-proof,

GILSULATE—nature's own insulation—is a unique, solidified hydrocarbon. It virtually installs itself: just pour it on...tamp...backfill—the job's insulated. Normal pipe-heat (up to 520° F.) does the rest—fuses the GILSULATE to the pipe in hours, forming a massive circular sheath. Three tough layers completely protect the pipe against heat loss, against water, all types of corrosion, any commonly-encountered buried-line condition. GILSULATE came from the earth and is simply being returned to the earth, where it has laid unchanged for millions of years.

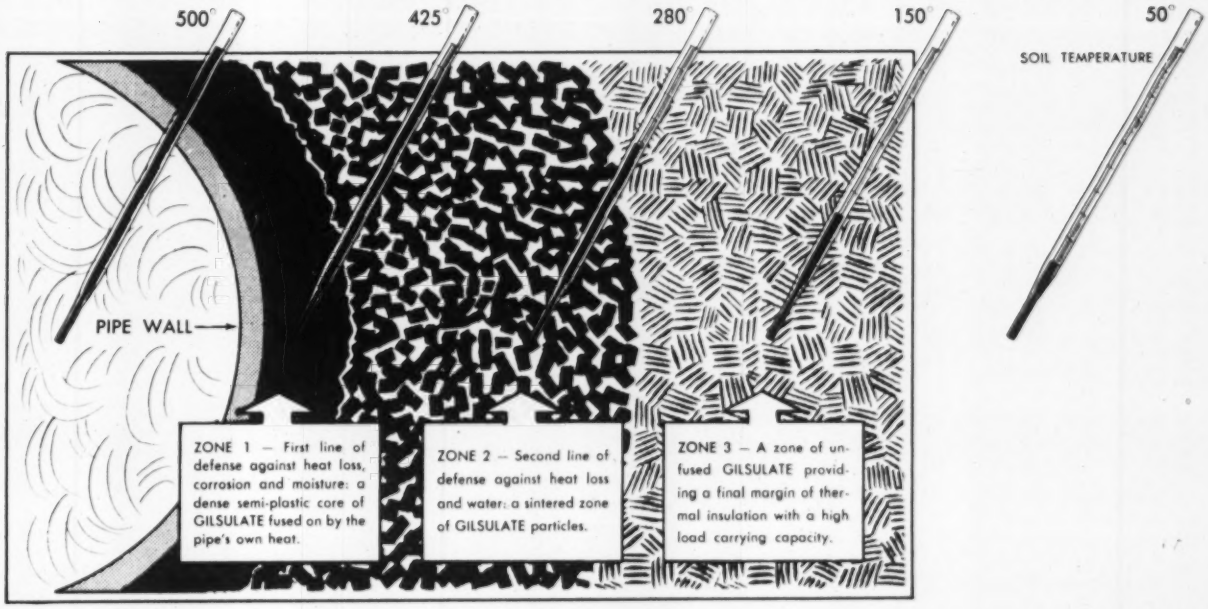
GILSULATE costs less installed per linear foot *than any other hot underground pipe installation*...it's easiest-to-use...and has been tested in scores of the country's largest and most important installations

For a demonstration, write or call your nearest dealer:

California	Los Angeles 15, Industrial Insulators, 1244 South Grand Avenue San Francisco 7, Western Fibrous Glass Products Co., 739 Bryant St.
Canada	Montreal, Engineering Equipment Co., Ltd., 874 Beaumont Ave. Toronto, Michael Stuart Co., Ltd., 116 Bloor St. West
Colorado	Denver 2, Jay and Cox, Inc., 2124 Broadway
Georgia	Atlanta, American Gilsonite Co., H. L. Armentrout, 831 Briarcliff Road
Illinois	Chicago 6, Ray O. Nelson Co., 330 South Wells Street
Indiana	Indianapolis 2, Jackson Engineering Co., Inc., 1531 N. Pennsylvania St.
Louisiana	New Orleans 6, Edgar Murray Supply Co., Inc., 232 Canal Street
Michigan	Detroit 26, John F. Wolff & Co., Penobscot Building, Rm. 702
Minnesota	St. Paul 14, Paul W. Abbott Co., 2288 University Avenue
Missouri	Kansas City 8, Anderson-Stolz Corp., 1727-33 Walnut Street St. Louis 1, Eagle Industrial Co., 119 North Seventh Street
New York	New York 7, A. F. Hinrichsen, Inc., 50 Church Street Syracuse 2, H. V. Boggs Co., 419 E. Jefferson Street
Ohio	Cleveland 6, William G. Jewett Co., 12417 Cedar Road
Oregon	Portland 4, Mead and Associates, 317 S.W. Alder St., Rm. 1100
Pennsylvania	McKees Rocks, Tutein and Bickell, 429 Broadway
Texas	Houston 11, Mundet Cork Corp., 6601 Supply Row
Utah	Salt Lake City 1, Williams, Gritton & Wilde, 204 Cooly Building
Washington	Seattle 66, Winsor Co., 20031 Marine View Drive, S.W.

* *GILSULATE is a blend of specially sized and selected Gilsonite, a unique solidified hydrocarbon of high resin content found only in eastern Utah. Gilsonite has been in use since 1887 in paints, inks, asphalt tile, storage battery boxes, etc. Its remarkable insulating properties are a recent discovery.*

can revolutionize the insulation of buried pipe installations...


500°
425°
280°
150°
50°
SOIL TEMPERATURE
PIPE WALL
ZONE 1 — First line of defense against heat loss, corrosion and moisture: a dense semi-plastic core of GILSULATE fused on by the pipe's own heat.
ZONE 2 — Second line of defense against heat loss and water: a sintered zone of GILSULATE particles.
ZONE 3 — A zone of unfused GILSULATE providing a final margin of thermal insulation with a high load carrying capacity.

that fuses itself into lifetime protection for corrosion-proof, root-proof, acid/alkali-proof

A few additional GILSULATE advantages:

- *3 grades available* covering 220°-520° F.
- *needs no sleeves* or mechanical sheaths to protect insulation
- *requires no mixing* or special handling
- *can't be punctured*—leave rocks in backfill
- *needs only normal pipe spacing*—steam and condensate lines can run side by side
- *pipe contracts and expands* within GILSULATE structure
- *repairs to pipe* are quick and easy
- *proved in actual use* in hundreds of new construction and replacement installations
- *widely preferred*—by heating, ventilating and mechanical engineers, architects, contractors in central steam installations, chemical and petroleum plants, construction projects, industrial power plants, utilities, and state institutions.

For descriptive literature, fill in the coupon below.

AMERICAN GILSONITE COMPANY
SALT LAKE CITY, UTAH
Affiliate of Barber Oil Corp. and Standard Oil Co. of California

GILSULATE can be used for replacement of old-fashioned, worn-out, or corroded insulation.

GILSULATE®

THE TRIPLE-ZONE INSULATION
FOR LIFETIME PROTECTION
OF HOT UNDERGROUND PIPES

American Gilsonite Co.
248 South Main St.
Salt Lake City 1, Utah,
or 1145 East Jersey Street, Elizabeth 4, N. J.

Please send me descriptive literature on GILSULATE.

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TITLE

COMPANY

ADDRESS

HPC

THIS SUPER Seal

(EXCLUSIVE IN SEALMASTER BEARINGS)

obsoletes old ideas on bearing maintenance costs

IT KEEPS dirt out AND grease in!

When dirt gets into bearings or grease leaks out, you've got trouble . . . high maintenance and replacement costs and all-too-frequent disassembly and downtime for machines.

Permanently Sealed SEALMASTER Bearings Were Developed to Lick This Problem

HERE'S WHY: In SEALMASTER Bearings, grooved, steel inner seals—permanently mounted on the outer race ring, one on each side, form the grease chamber.

Two annular felt-lined flingers rotating with the inner race ring and within the grooves of the inner seals, form the outer seals. The centrifugal action of these flingers effectively seals out all dirt. The bottom flanges of these rotating flingers, passing under and slightly beyond the inner seals, create a vortex action in the grease chamber. This breaks up the grease flow and retains just the right amount of grease to lubricate.

Whether your problem is dirt or simply making sure the bearings in the machines you make or use will give maximum service, SEALMASTER Bearings can help *you*. They are first class assurance of low maintenance costs and long bearing life! Write for Bulletin No. 845.

SEALMASTER

BALL BEARING UNITS

Cartridge Unit | Flange-Cartridge Unit | Flange Unit | Take-Up Unit | Pillow-Block Unit

SEALMASTER BEARINGS

47 Ridgeway Avenue, Aurora, Illinois

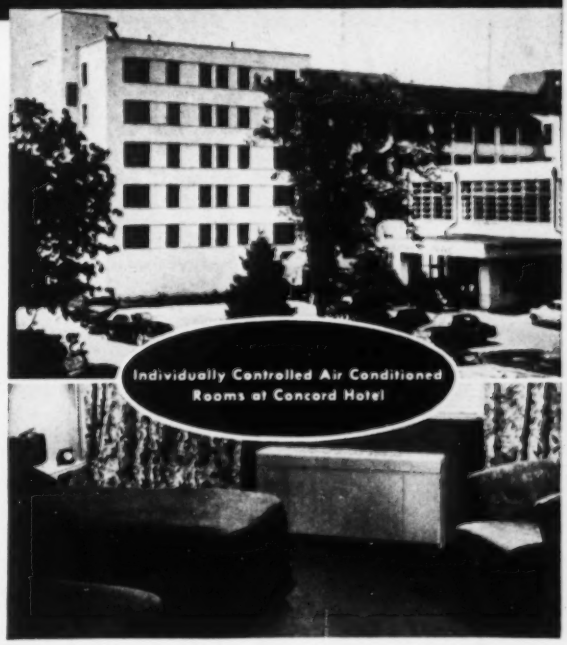
A DIVISION OF STEPHENS-ADAMSON MFG. COMPANY

FACTORY REPRESENTATIVES AND DEALERS IN ALL PRINCIPAL CITIES

Another interesting REMOTAIRE installation!

Individual-room remote type units in resort hotel provide year 'round air conditioning

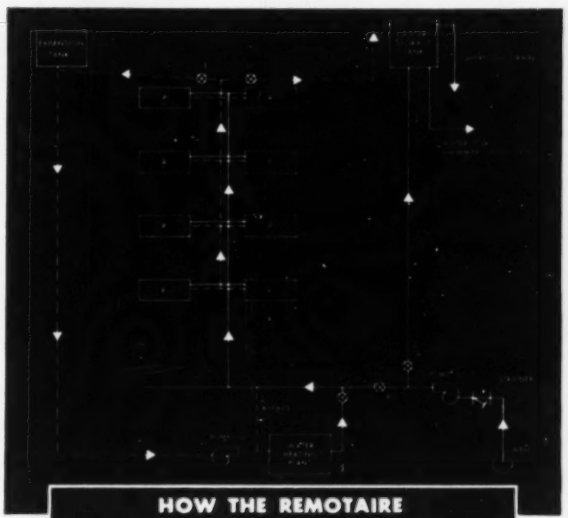
Summer cooling... winter heating



● The Concord Hotel, Kiamesha Lake, New York, found the answer to efficient, economical year 'round air conditioning through the installation of the Remotaire Well Water System—one of a number of different Remotaire systems available for multi-room buildings.

The Remotaire Well Water System may be used in localities where well water is known to be available in adequate supply, proper temperature, and of good quality. The cold well water is used in lieu of a water chilling plant. Consisting of Remotaire Room Units in each room connected by a piping system to the central plant equipment (as shown in the diagram), this system costs less to install and less to operate. Individual control of each Remotaire unit allows the occupant to choose the room temperature that suits him best without affecting adjoining rooms.

This resort hotel installation is another example of the versatility of the Remotaire for hotels, motels, hospitals, apartments, and other multi-room buildings.



HOW THE REMOTAIRE WELL WATER SYSTEM WORKS

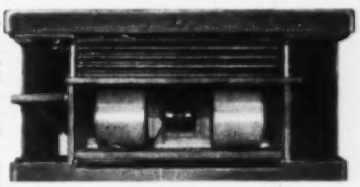
The Remotaire Well Water System consists of Remotaire Room Units in each room connected by a simple piping system to the central plant equipment—a well with pump, water heater, water circulating pump, expansion tank, storage tank and water filter or strainer as shown above.

FOR COOLING—Valves A and C are closed. B is open. Pump No. 1 pumps water from well to Remotaire units on each floor from which it travels thru valve D to storage tank on roof. This water is usable for swimming pool or other purposes.

FOR HEATING—Heating circuit includes Water Heater, Valve C, Valve E, Expansion Tank, Pump No. 2 and bypass. For operation, close Valves B and D, start Pump No. 2 and boiler, and the hot water circulates through the system.

When cooling is not required, well water may be used for other purposes, and can be pumped direct through Valve A to Water Storage Tank by Pump No. 1.

Top Quality Construction... Easy To Install



The Remotaire is sturdily built of heavy-gauge steel—plus a reinforced air grille—with a bonderized, baked-on semi-gloss enamel finish. All air passages are acoustically insulated for thermal efficiency and quietness. Coil is designed for right or left hand connections. Spacious end compartments permit easy access to coil connections and controls. Adaptable to a variety of ventilation systems, the Remotaire is ideal for modernization as well as new construction and is available in three models—200, 400 and 600 cfm.

Write for Remotaire Brochure, Form 298.

American Radiator & Standard Sanitary Corporation
P. O. Box 1226, Pittsburgh 30, Pa.

AMERICAN-Standard
HEATING-COOLING

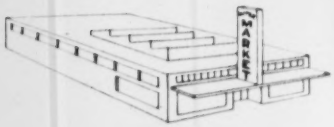
Serving home and industry

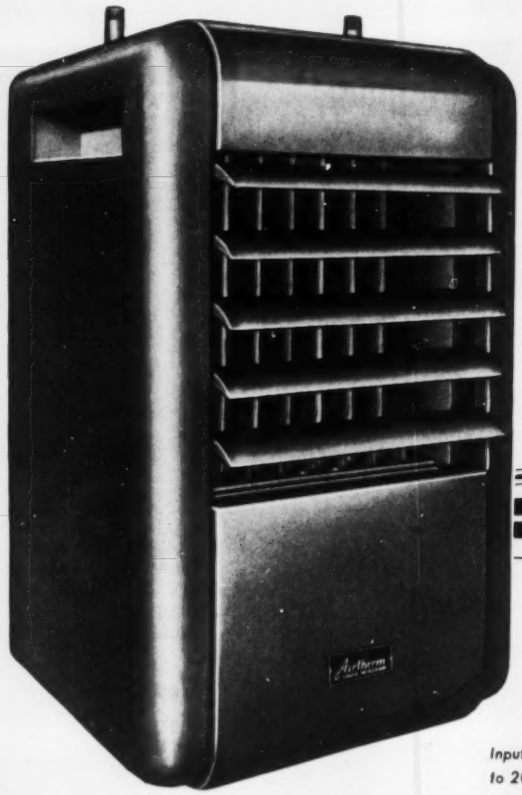
AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE
DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS

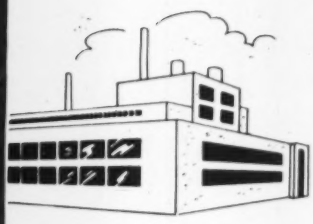
Put Heat Where You Need It . . .

Easily and Economically

with *Airtherm* GAS UNIT HEATERS







Input 25,000 BTU to 200,000 BTU

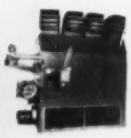
These attractive, self-contained units now give you new freedom and flexibility in laying out heating systems. For quiet, clean and completely automatic heat, they can be installed just about anywhere you can run a gas pipe.

In addition to general heating in commercial, industrial and institutional buildings of all kinds, you'll find Airtherm Gas Unit Heaters useful for many special purposes, such as drying, blanketing doorways, etc.

For complete data on gas unit heater installation with all types of gases, write for your FREE copy of Catalog 500.

For Heating Satisfaction . . . Think First of

Airtherm



Oil or Gas Direct Fired Heaters

Horizontal Type Unit Heaters

Convectors

Vertical Type Unit Heaters

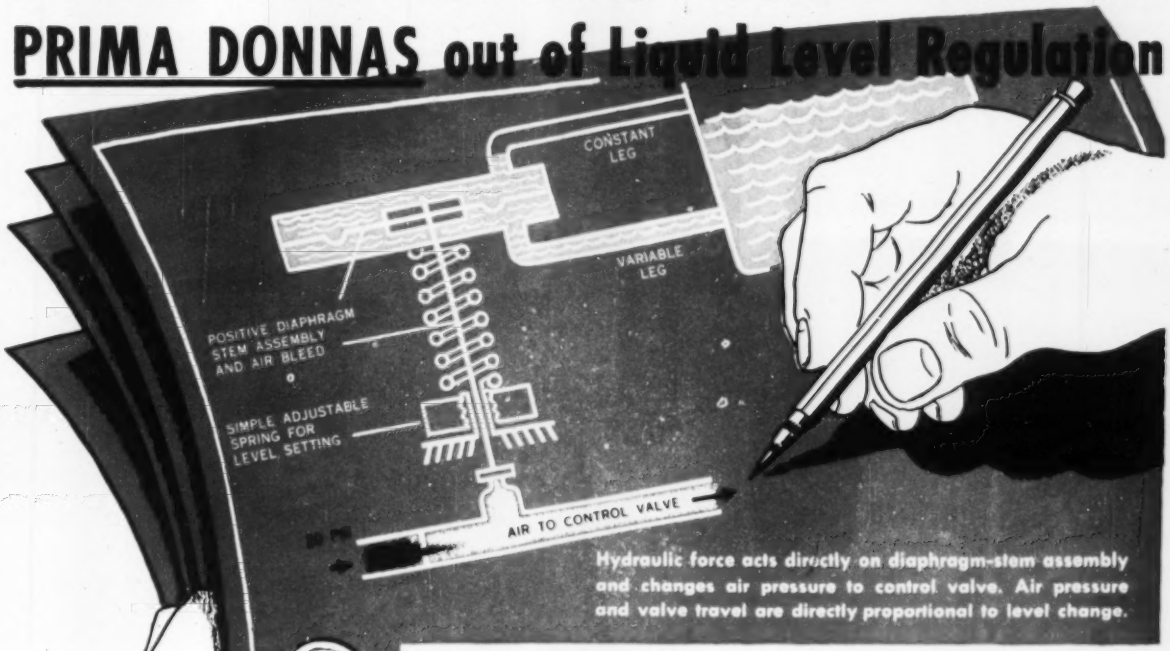
Centrifugal Fan Unit Heaters

Ask Your Wholesaler or Write

AIRTHERM MANUFACTURING COMPANY

711 South Spring Avenue • St. Louis 10, Missouri

LESLIE *Floatless* Level Control takes the PRIMA DONNAS out of Liquid Level Regulation


CONSTANT LEG
VARIABLE LEG
POSITIVE DIAPHRAGM STEM ASSEMBLY AND AIR BLEED
SIMPLE ADJUSTABLE SPRING FOR LEVEL SETTING
AIR TO CONTROL VALVE

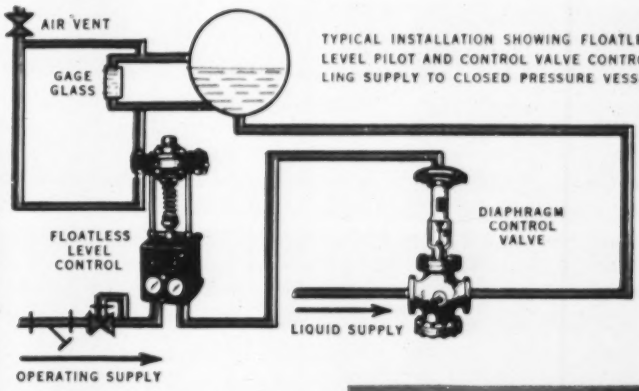
Hydraulic force acts directly on diaphragm-stem assembly and changes air pressure to control valve. Air pressure and valve travel are directly proportional to level change.

Here is level control that is not affected by surface agitation, equipment vibration, or the roll of a ship—a simple design that provides steady, positive, precise control even under extreme conditions.

Thousands are in service today, providing accurate control of liquid level (plus or minus 1" water column) and eliminating the problems caused by troublesome linkages, torque tubes, floats and stuffing boxes.

Note these special features—

1. **Can be installed anywhere below liquid level . . . on control panel, if desired.**
2. **Simple, compact, one adjustment unit . . . weighs only 40 lbs.**
3. **Diaphragm stem assembly is only moving part. Diaphragm element doesn't require recalibration during service.**



TYPICAL INSTALLATION SHOWING FLOATLESS LEVEL PILOT AND CONTROL VALVE CONTROLLING SUPPLY TO CLOSED PRESSURE VESSEL

SEND FOR DESCRIPTIVE DATA PC-37

When specifying . . .

Here's *another* LESLIE *standard* item to fit specifications that are *special* orders with most manufacturers. When specifying pressure, temperature or level controls—for new or replacement service—it will pay to check *first* with your nearest LESLIE engineer. He's listed in the classified telephone directory in principal cities . . . under "Regulators" or "Valves"

TRADE LESLIE MARK

TOPS IN QUALITY PRESSURE LEVEL AND TEMPERATURE CONTROLS

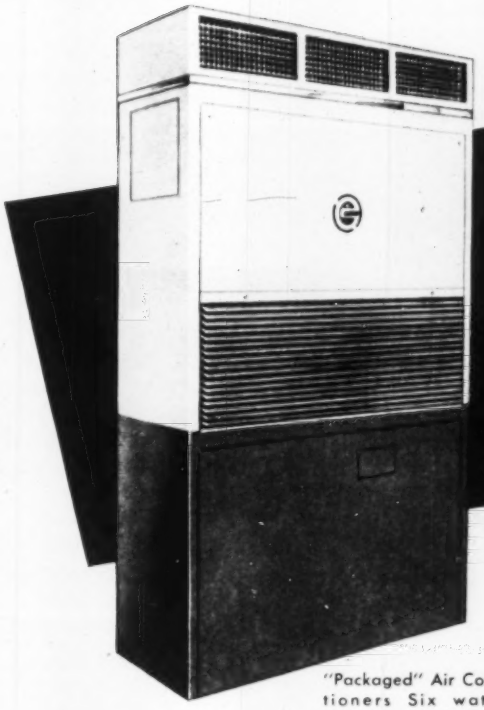
Since 1900

LESLIE CO., 237 Grant Avenue, Lyndhurst, New Jersey

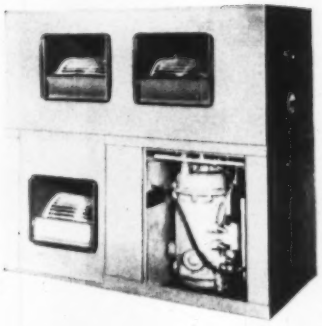
For PEAK PERFORMANCE on *All Refrigeration Systems*

CATCH-ALLS
SOLENOIDS
THERMOSTATIC EXPANSION VALVES
REFRIGERANT DISTRIBUTORS

SPORLAN VALVE COMPANY
7525 SUSSEX AVENUE ST. LOUIS 17, MISSOURI



"Packaged" Air Conditioners Six water-cooled models, from 2 to 15 h.p.



New "Packaged" Air-Cooled Air Conditioners use no water—require no plumbing. 2 and 3 h.p.

FEATURES THAT MAKE CHRYSLER AIRTEMP COST LESS TO INSTALL...

can make more money for you!

A Chrysler Airtemp "Packaged" Air Conditioner is unusually quiet in operation because the radial design of its compressor permits perfect balancing of cylinders. So, you can install the air conditioning unit right in the area to be cooled—or very close to it. This reduces the amount of ductwork required.

For other important reasons, too, you can often install Chrysler Airtemp at lower cost. Units are shipped to you *completely* factory-assembled, pre-charged with Freon. On the job, you can take conditioned air from the top of a unit, dispensing with the plenum, or direct it into the area from front or back simply by turning the plenum around. You can even "split" a unit easily, placing the compressor assembly on floor and balance of unit above shelving or other fixed objects.

Lower installation cost with Chrysler Airtemp gives you a competitive advantage which you can turn into more sales—more profit. And the installation time you save can permit you to handle more business—without adding manpower. Send coupon now for all the reasons why it will *pay you more* to sell the "Packaged" Air Conditioning which most people buy—Chrysler Airtemp.

Guaranteed by Good Housekeeping

Be sure to visit the

CHRYSLER AIRTEMP EXHIBIT

at the

8th ALL-INDUSTRY REFRIGERATION and AIR CONDITIONING EXPOSITION

Cleveland, Nov. 9 Thru Nov. 12

SPACE 412

Chrysler Airtemp

HEATING • AIR CONDITIONING

for HOMES, BUSINESS, INDUSTRY

Airtemp Division of Chrysler Corporation

Dayton 1, Ohio

Airtemp Division of Chrysler Corporation HP&AC 11-53

P.O. Box 1037, Dayton 1, Ohio

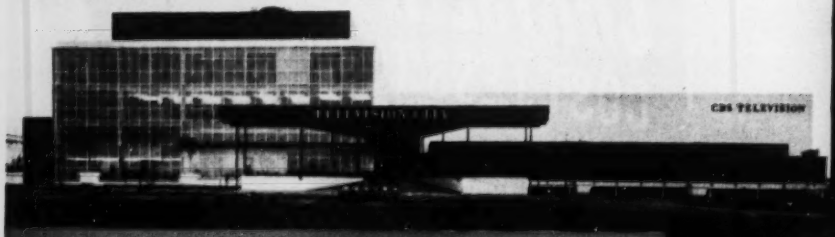
I would like to know more about the Chrysler Airtemp proposition.

Name _____

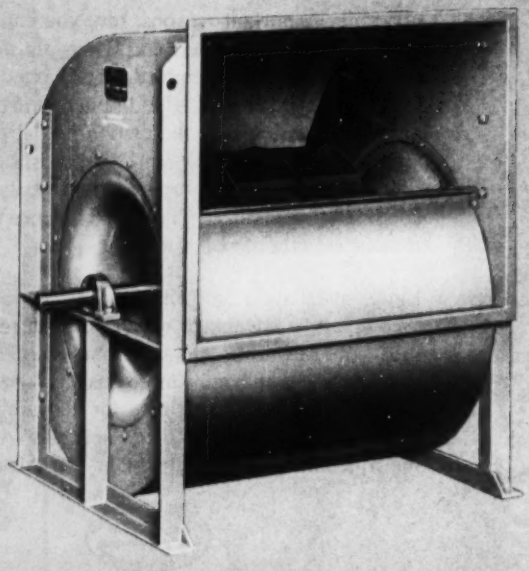
Address _____

City _____ Zone _____ State _____

QUIET ON THE AIR!



When all sounds must be strictly "according to script,"
quiet operation of blowers is essential.
Most talked-about architectural project in its field,
CBS Television City, Los Angeles, depends on Utility Blowers
to insure noiseless, efficient performance.



BUILT TESTED
AND RATED IN
ACCORDANCE WITH
A. S. H. V. E. AND
N. A. F. M. CODES
SIZES 6 TO 60

Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Producers of blowers and blower parts for original equipment manufacturers. Write for catalogue data.

UTILITY FAN CORP.

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A DIVISION OF UTILITY APPLIANCE CORP.

UTILITY

"Buffalo" *Tips on Better Pumping*

5 WAYS to get the Most From Your PUMPING INVESTMENT

1. Match The Pump To The Conditions

First, determine all possible conditions of the liquid to be pumped — chemical analysis, suction lift (if any), head or pressure, specific gravity and temperature of liquid — then pick the exact pump made for those conditions. (In the "Buffalo" line, you'll *find* that "ideal" pump, because the line is so complete.)

2. Save On First Cost By Using Highest Recommended Driver Speed

The higher the speed, the more the pump will deliver — within reason — and the smaller the pump you can use for a given job. But be sure to operate at no higher than recommended speeds. Overspeeding wears out any pump.

3. Right Installation Aids Performance

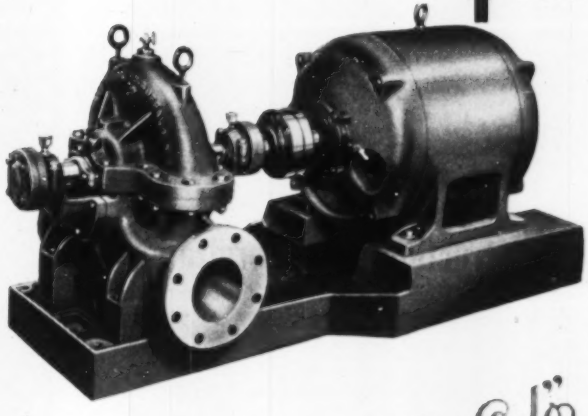
Give your pump the best chance — install close as possible to liquid supply source — keep pipe friction losses to a minimum — be sure suction line has no humps or hollows which could cause air locks. (You'll find "Buffalo" Pumps compactly built and easy to install)

4. Regular Maintenance Schedule Lengthens Pump Life

Regular inspections and servicing of bearing lubrication, shaft alignment, packing, impeller not only keep your pumps running smoothly, but head off minor conditions which could develop into problems later on. (You have a long-life "bonus" to start with if your pumps are "Buffalo"!)

5. A Quality Pump Is Always An Economy — Specify "Buffalo"

No installation can be better than its pump. For known quality that means long life, efficient performance and simple maintenance, pick the pumps used in many of the country's largest installations — "Buffalo" Pumps.



"Buffalo" Type SL Pump

for high-volume, high-efficiency clear water service, as air washing, chilled water or other air conditioning service. A double suction design with enclosed, hydraulically balanced impeller. 10 to 10,000 gpm capacities. *Write for bulletin 955.*

"Buffalo" PUMPS, INC.

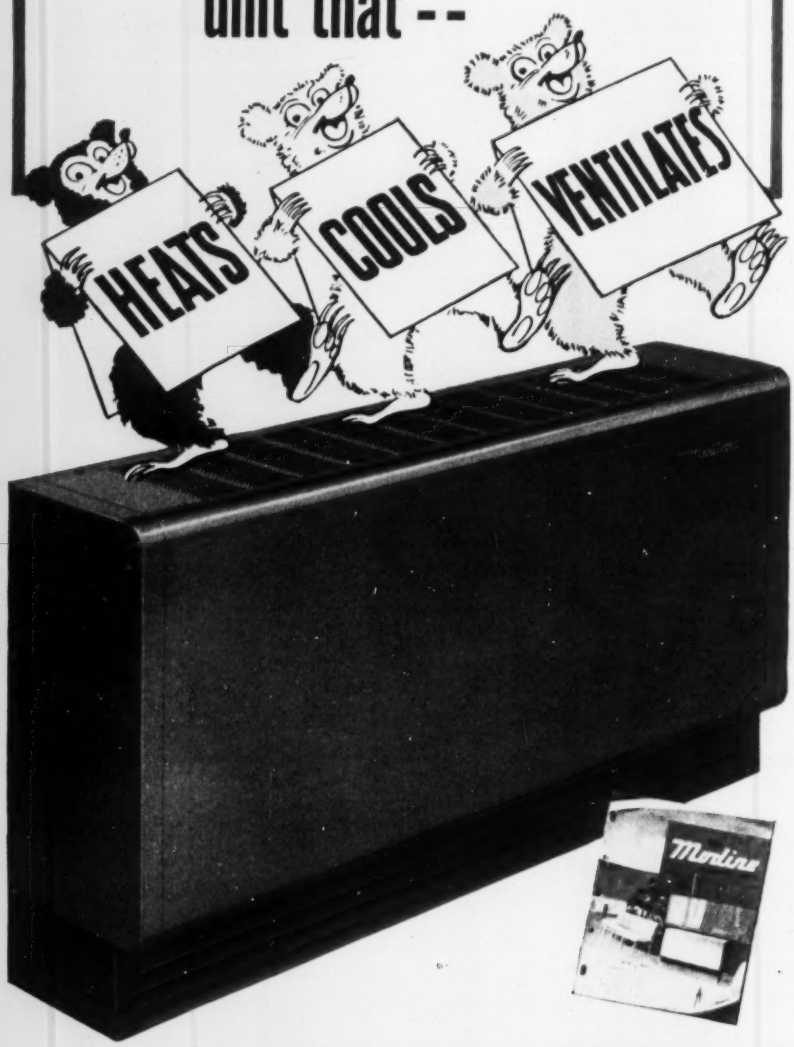
171 MORTIMER STREET BUFFALO, N. Y.

Subsidiary of Buffalo Forge Company

Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

Here's a single, economical unit that --



Yes, Modine Cabinet Unit gives you ALL 3

FOR year 'round comfort in large public rooms, nothing can match the economy and performance of Modine Cabinet Units.

With a single unit you get quick, positive, quiet distribution of heated *or* cooled air. Inexpensive accessories permit introduction, filtering, heating and distribution of fresh, outside air for ventilation.

And low cost is just one outstanding feature of Modine Cabinet Units. Their quiet beauty harmonizes with any interior.

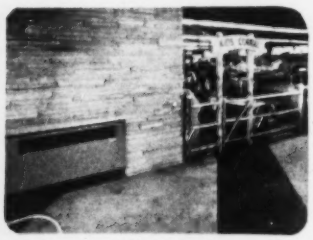
No need for bulky, old-fashioned heating equipment—one cabinet usually replaces two or three cast iron radiators. Recessed in walls or concealed behind a partition or false ceiling, they make difficult remodeling jobs easy.

You can choose from five different models — some for heating plus cooling with chilled water . . . others for heating with steam or hot water only. Ask the Modine representative listed in your classified phone book for Bulletin 552. Or write Modine Manufacturing Company, 1509 DeKoven Avenue, Racine, Wisconsin.

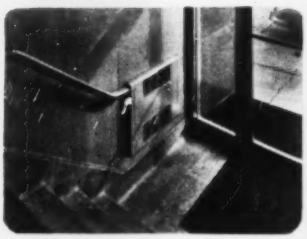
Modine
CABINET UNITS
C-1212

Here are three of many new construction or modernization possibilities

OFFICES. Year 'round comfort at lowest possible cost is provided this large office by economical Type BT Modine Cabinet Units.



STORES. Handsome as a convector but with four to five times the capacity, Type BF Cabinet Unit heats modern store uniformly.



LOBBIES. Wintry blasts from opening doors are no problem in this apartment. Type FF cabinet effectively warms lobby.

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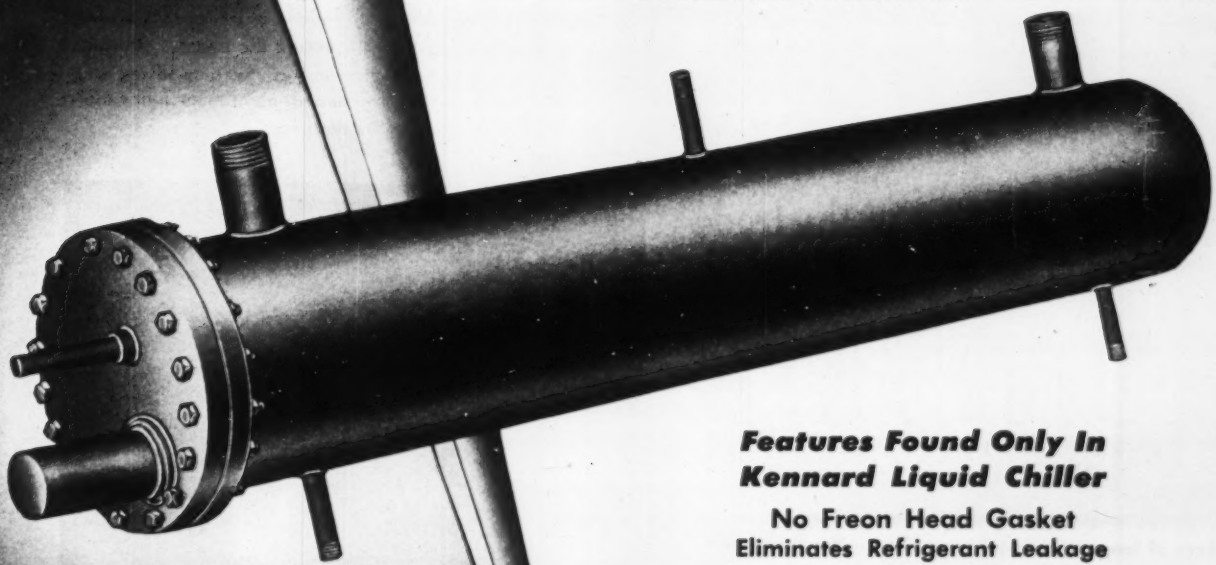
Engineered

Direct Expansion
SHELL and TUBE
LIQUID CHILLERS
FREON 12—FREON 22



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Tons

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50% Lighter and Smaller
The Fin In The Tube "Does The Job"

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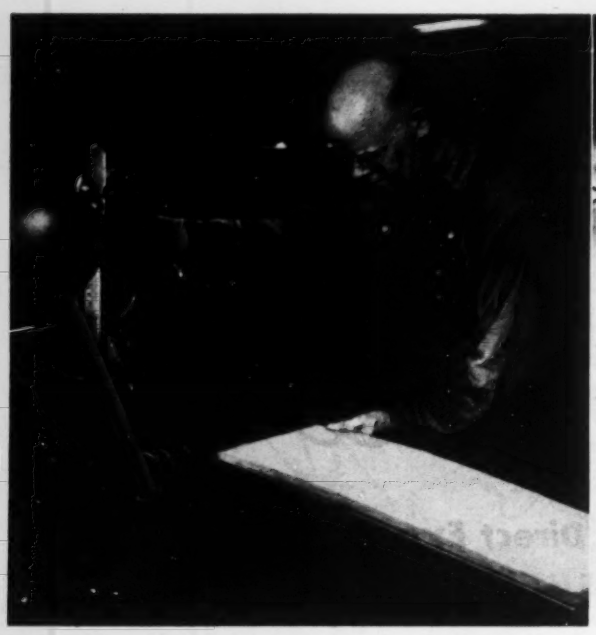

Ultralite Duct Liner, the long glass fiber insulation, has the rugged strength that enables you to acoustically line ducts at the same time you form them! Simply adhere Ultralite to metal before running it through brakes and shears. No danger of ruining the insulation on the truck or on the job, for Ultralite is resilient — won't flake or crumble.

Old hands report duct insulation savings up to 50% when they use the new "wrap-'n-staple" method of insulating ducts with ULTRALITE, the long glass fiber insulation. Simply wrap the duct with vapor-barrier-faced Ultralite. Use a special stapling gun to secure the seams.* (Ultralite has the tensile strength that makes this time-saving step possible.) Apply tapes over seams, paint them with waterproof mastic, and finish as desired.

Insulation "Tricks of the trade" that save you time with

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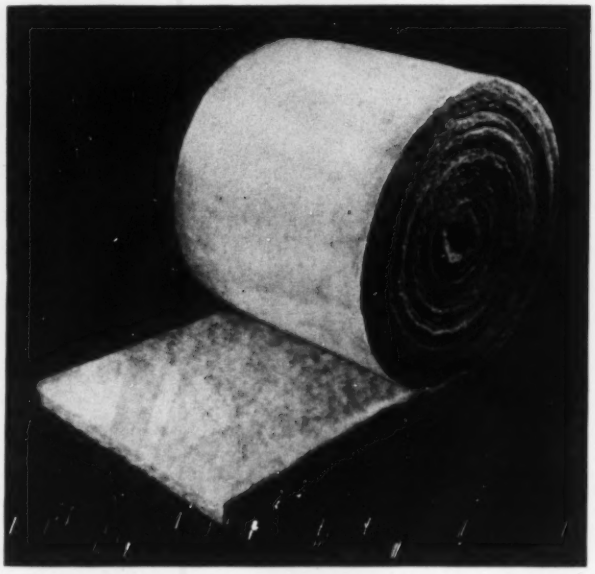
Duct Insulation and Duct Liner

ULTRALITE is the only duct insulation and duct liner of long, textile-type glass fibers. This "long-staple" strength makes it far easier and cheaper to store, handle, and apply. Ultralite is feather-light, fire-resistant, non-corrosive, non-irritating and will not flake or fall apart under vibration or air movement. It is available plain, or with 6 different facings, already adhered to the insulation.



*For details and delivery, call your ULTRALITE DISTRIBUTOR, listed in the Yellow Pages in major cities

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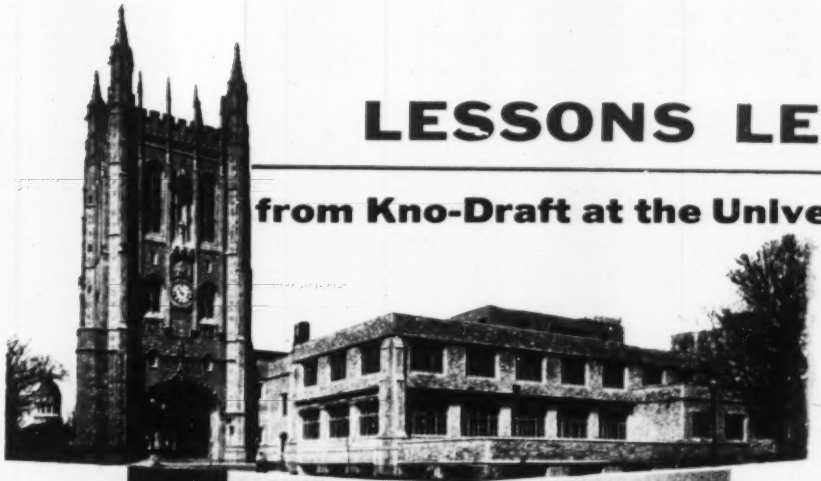
LESSONS LEARNED

from Kno-Draft at the University of Missouri



University of Missouri,
Union Memorial Building, Columbia, Missouri
Consulting Engineer:
John D. Falvey, St. Louis, Missouri
Mechanical Contractors:
A. C. Bishop Co., Columbia, Missouri

LESSON #1: Kno-Draft Adjustable Air Diffusers permit you to set and maintain the exact volume and flow pattern of conditioned air to assure maximum comfort—*uniform temperature without drafts*—throughout the conditioned area.

LESSON #2: The fact that Kno-Draft Diffusers are adjustable *after* installation simplifies preliminary "engineering" and assures flexibility to meet future changes in layout.

LESSON #3: Kno-Draft Adjustable Air Diffusers are "at home" with any architectural style, and there is a complete line of types and sizes to meet all requirements.

To learn more about Kno-Draft, send for the new edition of the Kno-Draft Data Book—complete up-to-date specifications, engineering and installation data on Kno-Draft Adjustable Air Diffusers. No charge or obligation. Mail the coupon or write to: Connor Engineering Corporation, Danbury, Conn.

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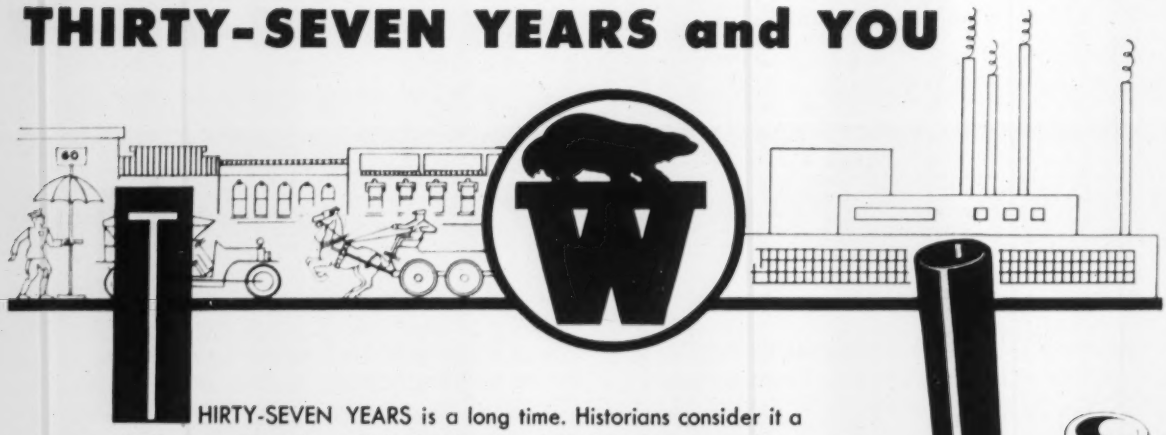
THIRTY-SEVEN YEARS and YOU



THIRTY-SEVEN YEARS is a long time. Historians consider it a generation. Many things happen in that length of time to change our lives. The passing years add experience that guides our forward steps.

Since the start of our business, thirty-seven years ago, many changes have taken place here at Wolverine. Each has been a step forward—the natural result of experience that has been constantly furnishing the inspiration for us to keep looking ahead in search of better ways of doing things, in order that we may bring you the best tube products that human effort, skill, and modern equipment can provide.

Our efforts are not alone confined to the manufacture of tubing, but also to finding ways and means that will make your application of tube most efficient and profitable.

As tube specialists, we interest ourselves in both the production of tube and its ultimate use. We feel it our responsibility to see that Wolverine tube functions to its fullest capacity. We know how to manufacture the finest tube that human skill and modern equipment can produce. Knowing where and how it is to be used, we can recommend the proper alloy—copper, copper-base alloy, electric-welded steel tube for mechanical, pressure and wet heat applications and aluminum (2S or 3S).

Besides plain tube, Wolverine has developed Wolverine Trufin*—the integral finned tube; Spun End Process†—an efficient forming process; and Capilator*—the capillary tube for restriction purposes.

It is reasonable to believe that our progress can help your progress.

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.

*REG. U. S. PAT. OFF. †A PATENTED PROCESS. RE. 22465

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Here is useful information for anyone and everyone interested in knowing how to make strong, permanently leak-tight joints in ferrous and non-ferrous piping and tubing with the oxyacetylene torch.

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WRITE FOR YOUR COPIES TODAY

Ask for Bulletin 17 and the "Torch Brazing Instruction Bulletin."

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WHEN YOU USE...

WALSEAL®

Cutaway view of a Walseal Tee showing: 1 – **factory-inserted ring** of silver brazing alloy; 2 – fillet of silver brazing alloy that appears upon completion of Walseal joint; 3 – cutaway view of the completed joint showing that silver brazing alloy has flowed in **both** directions from the factory inserted ring.

When you see this fillet of alloy, **and the fitting is Walseal** you know that you have full penetration because the alloy comes from the inside.

When you join brass, copper, or copper-nickel pipelines with Walseal Valves, Fittings, or Flanges you know you have the *right amount* of the *correct type* of silver brazing alloy. The ring of Sil-Fos brazing alloy is *factory-inserted* in the ports of Walseal products at the time of manufacture.

No lost time or motion in handling the alloy . . . no difficulty in getting *full penetration* of the alloy regardless of the position of the valve or fitting . . . no guessing whether the joint is made right . . . the fillet of silver brazing alloy that shows up when the Walseal joint is completed, *comes from the inside!* And, whether you've made the joint yourself, or are inspecting the work of another, you know that if the silver alloy fillet is visible, *and the valve or fitting is Walseal*, you have full penetration. That's why nobody guesses when you use Walseal!

Walseal products are backed by the reputation of the Walworth Company, manufacturers of valves and pipe fittings since 1842.

For full information regarding silver brazed joints made with Walseal products, write for Circular 115.

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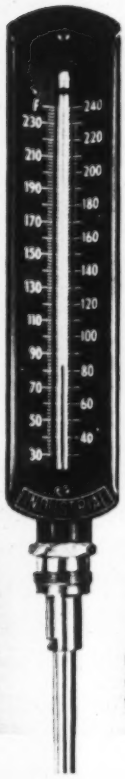
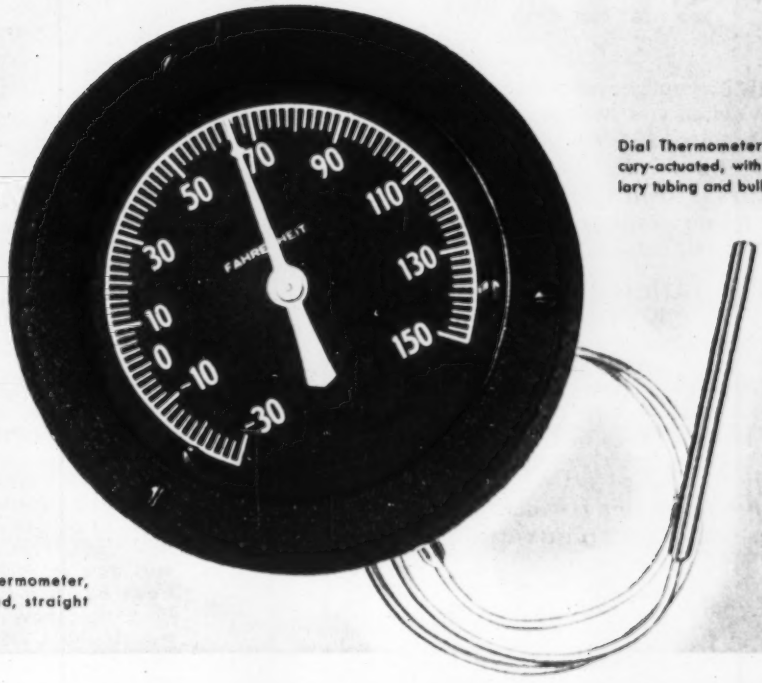


Industrial Thermometer, mercury filled, straight form.



Dial Thermometer, mercury-actuated, with capillary tubing and bulb.

HAVE YOU AN INDUSTRIAL TEMPERATURE TO TAKE?

Whenever an industrial temperature has to be taken there is a USG thermometer for the job. You have your choice of the Industrial Type in all sizes, and mounting forms with standard or protected stems; or the Dial Type in a variety of sizes, case styles, mountings, ranges, and connections. Gas, mercury or vapor-actuated.

For typical applications of commercial and approved Navy Standards, covering dimensional information and the use of bushings, flanges, sockets and special tubing, send for Catalogs 100 and 200.

Special thermometers for dough testing, milk testing, fuel gas, candy, solder baths, varnish, canning, vulcanizing and other unusual processes.

Industrial Thermometer of the 45° Recline Form. There are 5 other standard forms.

Dial Thermometer with bottom-connected rigid stem, one of many USG types available.

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United States Gauge
Division of American Machine and Metals, Inc.
Sellersville, Pa.

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How to Figure the cost of STEAM TRAPS

1. PRICE—you get a lot of trap for your money when you buy an Armstrong: big capacity in small size; the long-lasting mechanism in traps for low and medium pressures is identical in design, workmanship and materials, to that in traps for 900 degrees, 950 lbs. pressure!

2. INSTALLATION—Armstrong gives you a choice of body styles to save installation labor and pipe fittings.

3. MAINTENANCE—Armstrong traps last longer! You save labor, parts cost and downtime. Freedom from leakage saves fuel.

Divide total trap cost by the life of the trap to get *costs per year*—this is where Armstrong traps really shine. Call your Armstrong Representative for the traps you need now, or write:

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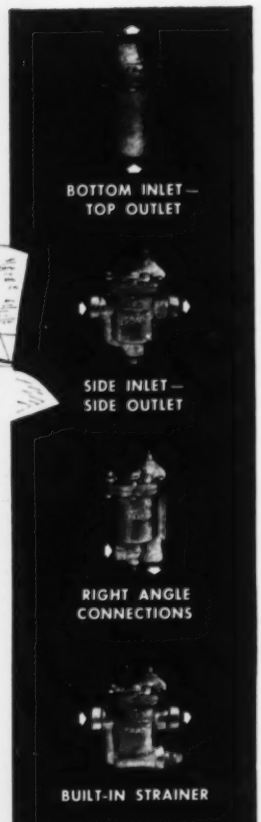
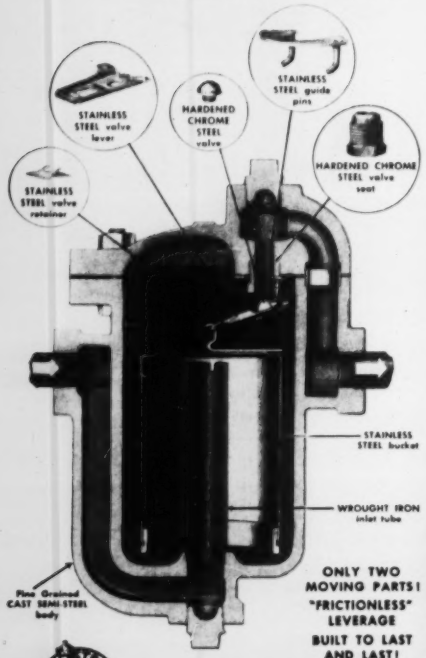


Full Facts In
FREE Catalog J

Catalog J, also an educational handbook on condensate drainage, gives sizes, prices and capacities of Armstrong traps. It tells how to select traps; how to make hook-ups; how to trouble-shoot. Send for a copy today.


STAINLESS STEEL valve lever
HARDENED CHROME STEEL valve
STAINLESS STEEL guide pins
HARDENED CHROME STEEL valve seat
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WROUGHT IRON inlet tube
Fine Grained CAST SEMI-STEEL body
ONLY TWO MOVING PARTS!
"FRICTIONLESS" LEVERAGE
BUILT TO LAST AND LAST!

STEAM TRAP CHECK LIST	ARMSTRONG TRAPS
Hardened chrome steel valve and seat?	Yes
All other parts stainless steel?	Yes
Long-lasting "frictionless" leverage?	Yes
Self-cleaning, non-clogging operation?	Yes
Choice of body styles?	Yes
Available with built-in strainers?	Yes
Available with internal check valves?	Yes
40 years inverted bucket trap experience?	Yes
Guaranteed *unconditionally* to satisfy?	Yes

ARMSTRONG STEAM TRAPS COST LESS!

IM-30

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INSTALL YOUR PIPES THEN INSULATE THEM!

WITH

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THE MODERN MONOLITHIC INSULATION FOR UNDERGROUND HEATED PIPING

Here's the easy, fast, economical way to install — *then insulate* — underground heated piping . . .

EASIER because the structural concrete base pad provides better working conditions, and because pipes can be welded on or below grade, and placed with no special care or handling.

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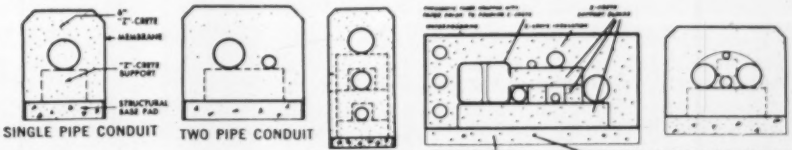

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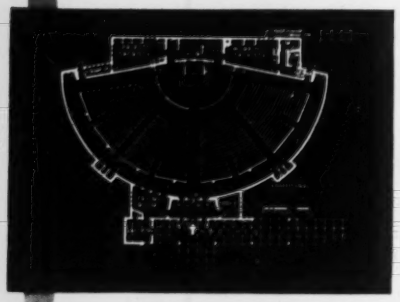
SARCOTHERM HEATING CONTROLS



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Engineers: **The Austin Company**
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CHURCH OF CHRIST THE KING, SEATTLE, WASH. Semi-circular arrangement seats 550 persons with no pew more than 50 feet from altar. Other features: 60-foot carillon tower; covered portico, stained glass clerestory.

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ARCHITECT PAUL THIRY'S inspiring design for Church of Christ The King is completely functional from its 60-foot carillon tower down to its weather modulated controls.

Radiant heating and the large attendance expected necessitated an extremely accurate, sensitive control system. To do the job, design engineers specified a Sarcotherm Weather Compensated Control System which insures comfort conditions inside regardless of outside temperatures.

Sarcotherm advantages of simple, low-cost, accurate control plus unique engineering service can help you design and install the most efficient system possible. A Sarcotherm engineer will be happy to advise you on your next project.

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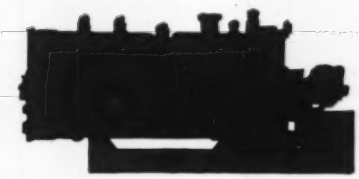
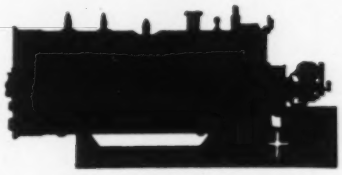
Weather Modulated Controls for **HOT WATER, RADIANT AND STEAM** *Heating Systems*

HOW SUPERIOR SOLVES YOUR STEAM PROBLEMS



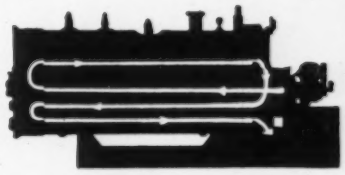
A COMPLETE PACKAGE

Completely factory-assembled and tested, a Superior Steam Generator is backed by undivided responsibility.



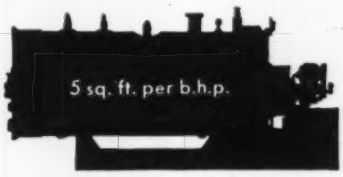
INDUCED DRAFT THAT'S BUILT-IN

...eliminates need of an expensive chimney... Multiple fans draw evenly on all tubes, reducing maintenance.



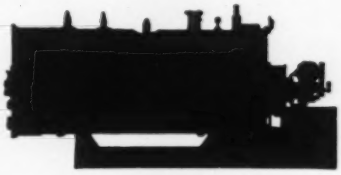
4-PASS, DOWN-DRAFT DESIGN

High gas velocities produce high efficiency. Down-draft design promotes rapid evaporation, quicker steaming.



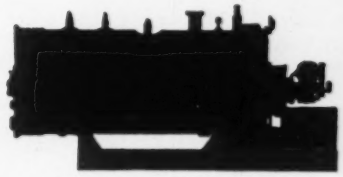
AMPLE HEATING SURFACE

A minimum of 5 sq. ft. of heating surface per boiler horsepower assures maximum efficiency at full rated capacity.



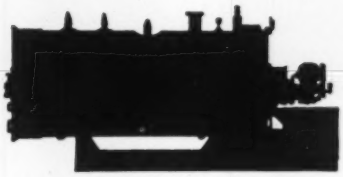
RESERVE CAPACITY

Greater steam space and large evaporating surface provide ample reserve capacity & better than 99% dry s. am.



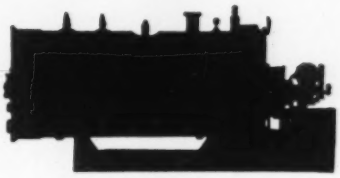
NO EXPENSIVE FOUNDATION

Built on a rigid channel iron base, a Superior Steam Generator needs only a floor capable of supporting its weight.



BUILT-IN CONTROLS

All controls essential to completely automatic operation are factory-wired into an easily accessible control panel.



BURN OIL, GAS, OR BOTH

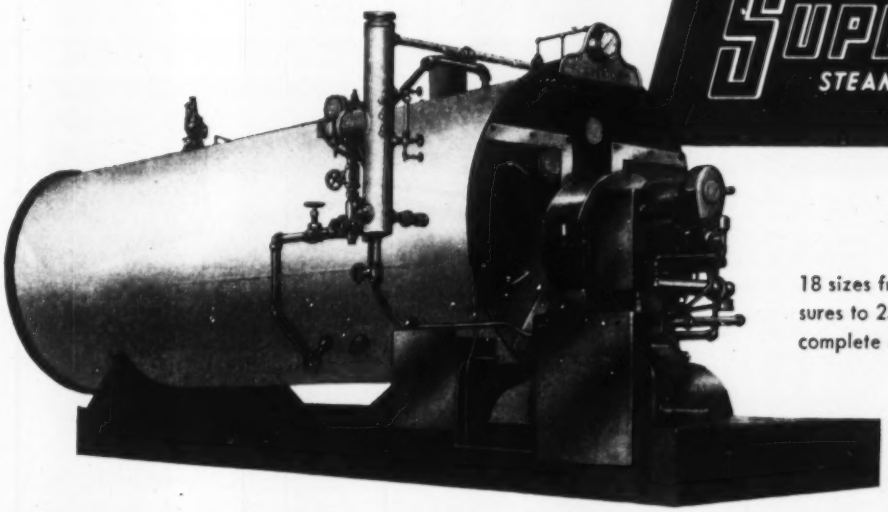
Superior Burners burn oil or gas or a combination of both... changing from one fuel to the other in seconds.

Superior Steam Generators are the ideal choice for a new steam plant... the simplest answer to expanding your present plant... the easiest solution to replacing obsolete boilers.

Guaranteed to develop maximum rated capacities at thermal efficiencies in excess of 80%, their design embodies features which insure long-lived dependability and maximum fuel economy.

for performance you can ***BANK*** *on*

SUPERIOR
STEAM GENERATORS



18 sizes from 20 to 600 b.h.p. for pressures to 250 p.s.i. or for hot water. For complete details write for Catalog 504.

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AIR CONDITIONING AND REFRIGERATION EQUIPMENT

This complete line of CURTIS equipment assures highest possible efficiency, dependability and quality . . . at a price that is profitable for you.

Not only will you be equipped to handle any installation but you will be selling equipment that is accepted the world over, and that is proven by 100 years of successful manufacturing experience.

To help you sell more CURTIS Air Conditioning and Refrigeration equipment, it is nationally advertised in *Saturday Evening Post*, *Time* and *Newsweek*, plus many other national magazines.

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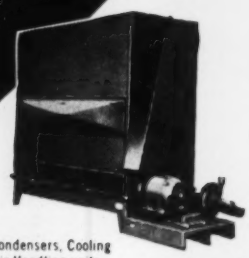
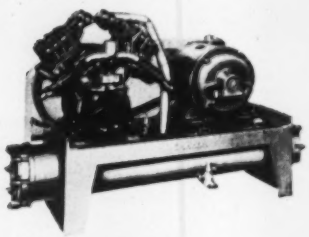
City.....Zone....State.....

Signed.....



Evaporative Condensers, Cooling Towers and Air Handling units to match

Packaged Air Conditioners—2, 3, 5, 7½, 10 and 15 tons



Condensing units—through 50 tons

Residential cooling and heating units

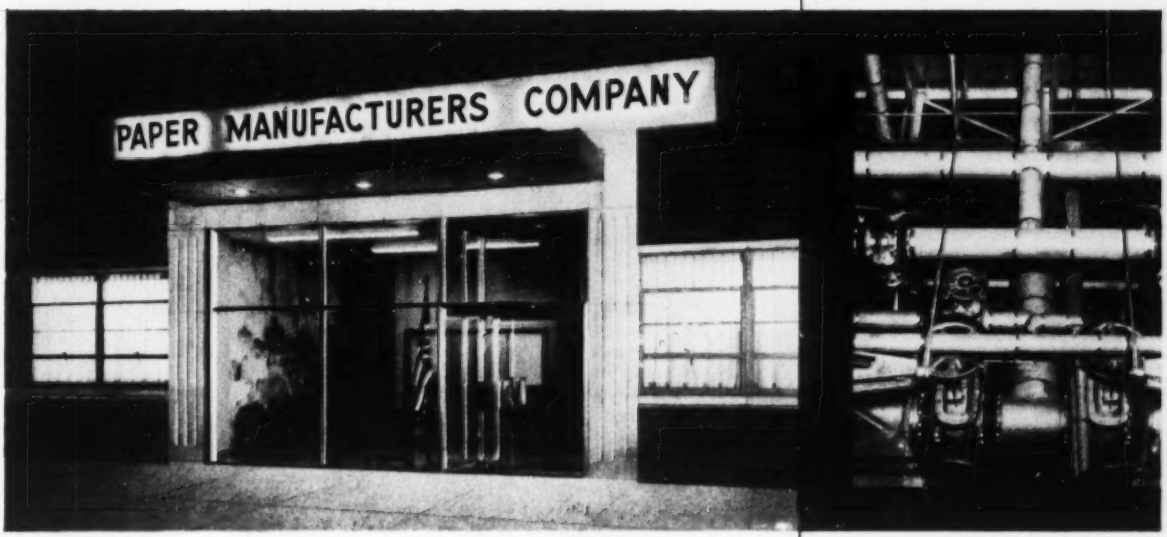
See our Exhibit . . . 8th All-Industry Refrigeration and Air Conditioning Exposition
CLEVELAND, NOV. 9-12, 1953 • BOOTHS 505-515

CURTIS REFRIGERATING MACHINE DIVISION
of Curtis Manufacturing Company
1950 Kienlen Ave. — St. Louis 20, Mo.

SPANG CW STEEL PIPE

contributes to PERFECTION for

Paper Manufacturers Company



Quality control is essential to Paper Manufacturers Company's production of its *Perfection* line of specialty papers. A leading paper converter, PMC produces a first quality line of paper rolls for teletype, adding and calculating machines, as well as a wide variety of gummed and heat seal papers.

Quality-consciousness naturally led to the specification of Spang CW Steel Pipe for PMC's up-to-date Philadelphia plant. There Spang CW carries the load . . . in heating, plumbing and air conditioning lines, plus special lines for processed steam, chilled water, compressed air, and high and low viscosity oils.

In the production of Spang CW Steel Pipe, too, *quality control* plays a key role. Close temperature limits, rigidly adhered to . . . the most modern production machines and control devices . . . strict inspection during every operation—all contribute to Spang CW's high standard of quality and reliability, make it easy to cut, thread and bend. Small wonder that Spang CW is consistently the first choice of quality conscious Owners, Architects and Engineers—and of smart contractors as well.

Let quality and reliability be *your* guide. Don't just ask for pipe . . . specify Spang CW at your distributor's.

Owner: **Paper Manufacturers Company, Philadelphia, Pa.**

General Contractor: **Joseph Nay Industrial Operations, Inc., Indianapolis, Indiana**

Piping Contractor: **Irwin H. English Company, Philadelphia, Pa.**

SPANG

SPANG-CHALFANT

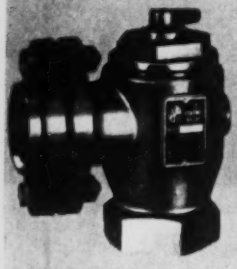
DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Office: Pittsburgh 30, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis.

4 REASONS WHY B&G Hydro-Flo* Heating IS COMPLETELY DEPENDABLE

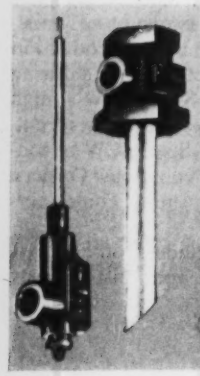
B & G MONOFLO FITTINGS

Not just "scoops" or "chokes" but engineered devices which assure the proper distribution of hot water. Only one fitting per radiator normally required.



B & G FLO-CONTROL VALVES

Straight and angle pattern valves which positively prevent gravity circulation when pump is not running. Easily cleaned *without breaking pipe connections!*



B & G AIRTROL SYSTEM

The combined action of B & G Airtrol Tank and Boiler Fittings traps air in the compression tank and prevents its return into the system. A genuine remedy for air trouble.

B & G *Hydro-Flo* forced hot water heating units provide the last word in automatic radiant comfort heating. You can depend upon them to give more value per dollar because *they are designed and built that way!*

In the B & G plant, the most modern manufacturing methods, scrupulous inspection and advanced engineering enable the company to produce equipment of custom quality at mass production prices.

B & G *Hydro-Flo* Products measure up completely to the standards by which every intelligent dealer judges the merchandise he recommends and sells. These standards are . . . good product . . . adequate service facilities . . . manufacturing responsibility and consumer acceptance.

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THE EDITORS' PAGES

"READER PARTICIPATION" is something every magazine very much desires. HPAC particularly welcomes suggestions and comments. You are invited to contribute your views to the monthly "Open for Discussion" department. Then, too, questions on heating, piping and air conditioning — and answers to published questions — are solicited for the regular Question of the Month feature. Just address the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2. We'll be glad to hear from you.

Management Report Sees Big Air Conditioning Growth

THE AIR CONDITIONING industry's annual sales — including industrial, commercial and residential installations — will exceed $5 billion, according to an appraisal distributed by the American Institute of Management, 125 E. 38th St., New York 16, to its 12,000 members.

Virtually all major office buildings constructed since the war have included complete air conditioning, the report observes. "The industry has directed major attention at the potentials for air conditioning in new multi-story buildings. However, the market for complete control of temperature and humidity in existing buildings also deserves careful examination, which it now is getting."

Real estate experts say that once the amount of air conditioned office space in any particular city reaches a given point — estimated at 15 percent of desirable space available — owners of buildings which do not have it will be forced to install air conditioning in order to maintain rentals and keep their tenants, says the AIM. This point is rapidly being approached in many areas, according to the report.

Air conditioning promises to be a "recession proof" industry, the report declares, making it an important factor in preventing a business downturn from deepening into an all-out depression. Just as electric refrigerator sales continued to rise during the last depression, it points out, so will this "new industry" continue to expand despite adverse business conditions.

"A business recession would have a positive effect on the sale of air conditioning," the report says. "Retail sales would become more competitive and stores would be forced to install air conditioning to keep their present customers and to attract additional buyers. The necessity for increased productivity at lower unit costs would become more urgent, improved quality would be demanded, and the introduction of new products and the acceleration of drug, petro-chemical and other new industries encouraged, with the result that precision controls and increased mechanization requiring air conditioning would be on the increase.

"In like manner, the competitive position in the housing field would be such that all homes necessarily would be offered fully air conditioned, while rental properties not already possessing this feature would have to be modernized with air conditioning to retain tenants."

Notes Upturn in Market for "Big" Air Conditioning

NOTING A MARKED upturn in the market for "big" air conditioning, Carrier Corp. reported last month that its orders for central air conditioning and refrigeration systems through the end of August were 42 percent above those for the same period in 1952.

Charles V. Fenn, vice president and general sales manager of Carrier's machinery and systems division, said that this year's rise in orders is nearly four times the average annual growth in the corporation's sales of such equipment since World War II. The yearly increase during the seven years following 1945 averaged about 11 percent, he said.

Contributing substantially to the current upward trend are the owners of more than 60 multi-story office buildings who have contracted for installations "during just the past 90 days," he reported early last month. The list includes not only many new projects, but for the first time a substantial number of large existing structures which are undergoing modernization. Thirteen of the orders are for New York City. Among the major recent office conditioning contracts is one for the existing Irving Trust building, New York City, which will have over 1500 tons of capacity.

An important element in this boom in "big" air conditioning is the fact that in many large cities the trend toward new completely air conditioned buildings is forcing owners of structures without air conditioning to modernize as the only way to secure first class tenants and employees, Mr. Fenn stated. Virtually every big office building erected since the war has included central station air conditioning throughout.

"In many cases, it has proved economically more feasible to modernize an older building than to build a new one," Mr. Fenn pointed out.

"Little Red Schoolhouse" To Promote Heating

"YOU CAN'T SELL heating or air conditioning installations on a 'plug-in basis' — they must be engineered," said R. E. Moore, vice president and secretary of the Bell & Gossett Co., at the dedication of his company's "little red schoolhouse" on the plant grounds in Morton Grove, Ill. Some 18,000 sq ft of space at the plant is devoted to research; purpose of the new facility is to follow up with educational activities for engineers, contractors, architects and journeymen, he said.

He predicted heating and cooling for entire communities from central plants, greatly increased use of snow melting for airport runways, walks and driveways, and use of ground coil heating by truck gardeners to lengthen the growing season.

The new building — complete with school bell — is air conditioned (two 5 hp compressors), has a projection booth for films and sound, the latest type of fluorescent lighting with dimmer control, can accommodate around 100 "students." It was originally a pattern shop that has been completely reconstructed.

"We are interested in people more than anything else," said Clarence E. Pullum, vice president and treasurer of the company, at the dedication ceremonies. He mentioned a shipping clerk who recently did a real sales job by inviting a customer's irritated truck driver to have a coke while he was waiting for an order to be loaded.

E. J. Gossett, president of the company, told those assembled for the dedication that, while it reminded him of his boyhood, the "schoolhouse" would fill more than a sentimental role in the company's affairs by leading to better engineering and installation procedures in the use of its heating, cooling, heat exchange and pumping equipment.

20th Directory Section Now Being Compiled

THE COMPLETE Directory Section of Heating, Piping and Air Conditioning Equipment for Industrial, Commercial, Institutional and Public Buildings — thoroughly revised and brought up-to-date — to appear for the 20th consecutive year in the January HPAC is now being compiled.

Thousands of listing sheets have been mailed to the manufacturers of the hundreds of items of equipment used in heating, piping and air conditioning installations in plants and big buildings for the latest authoritative information on what equipment will be available where during 1954. The information will be carefully classified for your use, along with the manufacturers' complete street addresses and trade names.

A new feature will be an additional classification by products of all equipment advertised in the same issue in which the Directory Section appears.

To all those who are cooperating with us in assuring the accuracy and completeness of the listings, we wish to express our thanks.

Large Manufacturer Marks 40th Year

THE TRANE CO., one of the nation's large manufacturers of air conditioning, heating and ventilating equipment, is observing its 40th anniversary this year.

The company was incorporated in 1913 to market James A. Trane's patented traps and valves for steam radiators.

First year sales were less than $50,000, but net sales since 1942 have jumped from $8 million to more than $42 million in 1952.

Trane, biggest employer in La Crosse, Wis., with more than 2100 workers in six plants, also has plants in Scranton, Pa., and Toronto. There are 250 salesmen, in 87 U.S. and Canadian offices, most of them graduate engineers.

Stoker Makers Meet, Discuss Sales Methods

AT THE ANNUAL meeting of the Stoker Manufacturers Association, held in Cleveland last month, all the officers were re-elected for the ensuing year. The SMA president is L. C. Dubs, president of the Canton Stoker Corp.

Business sessions included open forum discussions on several phases of the industry's operations and problems — mainly sales and merchandising programs "which will produce a greater volume of stoker business in the face of the stiffest competition in history." While it was generally agreed that the present situation presents a serious challenge to the industry, a significant trend was disclosed in the statements of numerous sales executives of member companies that better selling methods, improved equipment and service, and a more complete line of auxiliary boiler room equipment for commercial and industrial applications, are producing more satisfactory results in sales volume for numerous members of the association.

"Quote"

"Current indications predict a tremendous growth in the air conditioning field and we expect that our large installation air conditioning and refrigeration sales will be at least 25 percent greater by the end of next year. In the commercial field utilizing the smaller packaged air conditioning units, we expect a 70 percent increase in our sales during the same period. Expansion in residential air conditioning seems limitless." — MATTHEW M. LAWLER, Vice President, Air Conditioning & Refrigeration Div., Worthington Corp.

RACCA Announces New Program

A NEW PROGRAM has been released to the members of the Refrigeration & Air Conditioning Contractors Association, 228 N. LaSalle St., Chicago 1, according to Ray Kromer, the RACCA's executive vice president.

Major parts of this long-range plan for contractor-members are:

1) Promote the "qualified refrigeration and air conditioning contractor". A pattern of procedure has been prepared for affiliated local associations to provide the purchaser with information in selecting a contractor.

2) Data on sales procedures, financing, maintenance, and all phases of management.

3) Closer cooperative association with manufacturer associations and their members to solve problems of distribution, installation and service.

4) Speakers' bureau for local association meetings, and speaker pools for commercial, industrial, church and club meetings.

5) Educational programs for sales engineers and mechanics.

6) Better labor relations between contractors and union and between contractors and mechanics.

Perhaps Indelicate, But Worth Belonging To

THE "NEVER-SWEAT set" is what New York's Sunday News calls those who enjoy the benefits of air conditioning at work and at home. While perhaps the term is a bit indelicate ("women glow, men perspire and only horses sweat", according to an old saying) it's a good set to belong to, and millions are joining it — as the News pointed out.

Ottumwa, Iowa, Hospital, built 1952. Architect: Morgan-Gelatt & Associates, Burlington, Iowa. Consulting Engineers: Beling Engineering Co. General Contractor: Ringland, Johnson, Inc., Des Moines, Iowa. Mechanical Contractor: Mechanical Constructors, Inc., Moline, Ill.

WALL-to-WALL WARMTH

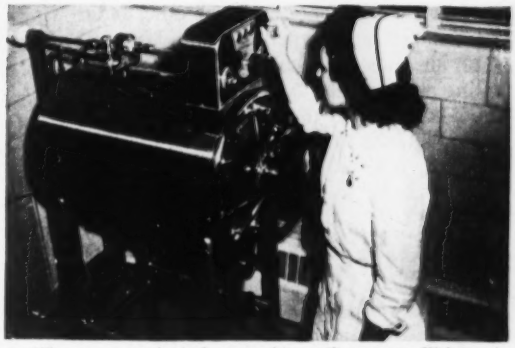
For New 133-Bed Iowa Hospital

New Ottumwa Hospital, 28th hospital design completed by Architect Dane D. Morgan of Morgan-Gelatt & Associates, has wall-to-wall warmth assured by Tru-Perimeter hot water heating using Webster Walvector.

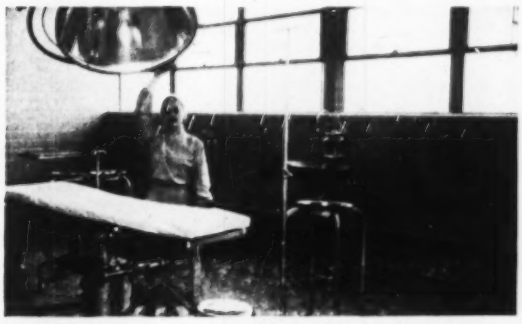
The new 133-bed Ottumwa, Iowa, Hospital, a community project built on a 40-acre tract, replaces a hospital group which for 60 years had struggled with space problems. The new hospital has 95,287 sq. ft. of floor space, 716 sq. ft. per bed, and was built at a cost of $14.88 per sq. ft. or $12,789.51 per bed. It has a maximum bed capacity of 175. Total cost of building and equipment was $1,800,000.

Beling Engineering Co., Consulting Engineers, recognized the need for wall-to-wall warmth in every room. As a result, patients and personnel enjoy the comfort of a zone-controlled hot water system with "Tru-Perimeter" Heating by Webster Walvector. Water is heated by steam converters in penthouse.

Webster Walvector heats all exposed walls, gives gentle, even warmth. No cold spots, hot spots or drafts. Heating element and piping are concealed in attractive metal enclosures. Piping is simplified, fewer risers needed.



Where space is limited, as in this sterilizer room, Webster Walvector conserves floor space. Assures comfortable warmth, but is never in the way. Sterilizer is equipped with special Webster Process Steam Trap for fast heating-up . . . standard on all leading sterilizers.



Operating Room. Webster Walvector offsets heat loss from large glass exposures here and in nursery and obstetric suite.

Whether you are considering new construction or modernization, investigate the advantages of Webster Walvector. For complete information, call the Webster Representative near you, or write us.

Address Dept. HP-11

WARREN WEBSTER & COMPANY

Camden 5, N. J., Representatives in Principal U. S. Cities

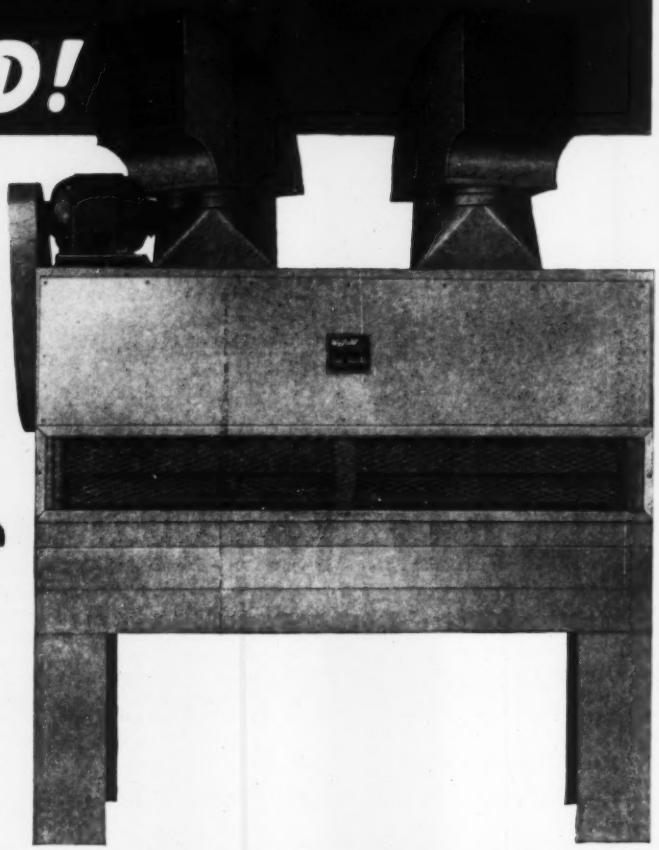
In Canada, Darling Brothers, Limited, Montreal

Webster WALVECTOR

REG. U. S. PAT. OFF.

For Steam or Hot Water Heating

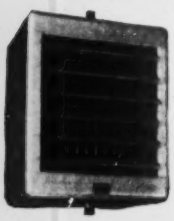
CHALLENGED!

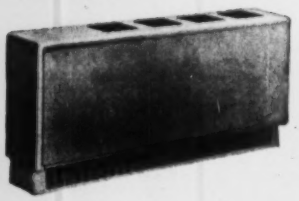


IN THE W-N LINE OF CHAMPIONS THIS UNIT HEATER IS THE GIANT

What's *your* problem? Factory—machine shop—hanger—garage—warehouse? Some other industrial or commercial installation where large volumes of air must be handled for heating or ventilating with speed, comfort and economy? No difficult job defies the W-N Giant. Made in nine sizes (83,000 to 1,735,000 Btu) and floor, wall, ceiling, inverted types. *Pub. WN-135.*

Your perfect assurance – Webster-Nesbitt!





When the problem calls for unit heaters you will *WIN* with *W-N*. Two great names in thermal engineering—Webster and Nesbitt—have teamed to give you this proved line of unit heater champions. Each holds title in its respective field. Separately and together, they back your own good name by star performance on every count: volume; capacity; temperature rise; distribution; comfort; quietness; long life; economy; and appearance.

Little Giant Unit Heaters — Propeller-fan units with blower-fan characteristics for factories, garages, doorways. Capacities, 23,900 to 348,000 Btu. Publication WN-134.

Propeller Fan Unit Heaters — Standard W-N suspended type for stores, shops, offices. Compact, quiet and efficient. Capacities, 34,700 to 338,000 Btu. Publication WN-126.

Series R Unit Heaters — Cabinet types (floor, wall, inverted); blower fans; for lobbies, corridors, etc. Steam capacities, 158 to 588 edr; air, 518 to 1890 cfm. Pub. WN-133.

Webster

"OPEN FOR DISCUSSION"

WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

[The Air Filter Institute's new code for testing air filters was described by A. Nutting and R. F. Logsdon in the June HPAC. Because of the interest in and importance of the subject of testing and rating air cleaning devices, considerable attention has been given since then to comment — both pro and con — on the code. Messrs. Nutting and Logsdon will reply to these comments next month.]

R. S. FARR —

"Air Filter Code Retards Progress"

MESSRS. NUTTING AND Logsdon replied — in the September HPAC — to my objections to the Air Filter Institute's code for testing panel type filters. They said — among other things — that this new code provides a direct and practical common yardstick for measuring filter performance and further that the code provides the "three essential factors necessary for judging comparative air filter performance: (a) resistance to air flow; (b) efficiency, average and at all stages during loading; and (c) dust holding capacity."

My basic objection to this code is that satisfying these three so-called "essentials" is the only thing this code does and that these three "essentials" were satisfied by the old ASHVE code. The AFI code simply changes the dust and the method of measuring efficiency. It does not add to the available information on filter performance and therefore is not an advance in the art and science of filter testing. Universal acceptance of the AFI code would not, therefore, provide the common yardstick for measuring filter performance since it provides no means of comparing all types of air cleaning apparatus.

I agree with Messrs. Nutting and Logsdon that the admitted desirability of testing with so-called classified dusts of known characteristics is not a point of argument. Just as the adoption by the AFI of standardized fine air cleaner test dust (Arizona road dust) as a component of their test dust admits the superiority of this uniform, though not "cleanly" fractionated, dust over the old Pocahontas ash, so tests made with narrow particle size band fractions of this same dust will give even more and better information on filter performance. That one sample of a narrow band fraction was not within the inferred limits does not mean that the fraction is useless. Re-naming the fraction to conform more nearly to its true nature would not change its character or its usefulness. The fact that the fraction is reproducible and has been used for hundreds of hours of testing has established it as a permanent part of our filter testing procedure. Efforts to "clean up" the fraction should not be abandoned, nor should a defeatist attitude prevent obtaining data with several different fractions even though they do not strictly conform to the ideal specification.

As to the "absolute" filter material, we have used the glass wool pad made of the "AA" fiber for years. It is a fact by our weight tests on this material that, in 24 in. square pieces, it is frequently as low as 85 percent efficient in catching what we call our 0-5 micron fraction of Arizona road dust. If this fraction contains oversize particles, it should raise the efficiency — not lower it. My contention that this "AA" fiber pad is not 99 percent efficient on fine dust is based on careful tests, not suspicions or misinformation.

Being written around viscous coated impingement and dry types of panel filters, this section of a presumably comprehensive code provides no prospect of being able to evaluate combinations of these types with other types. It also presents no prospect of being able to compare, on one basis, the performance of electrostatic, viscous impingement, dry, and mechanical types of air cleaners and dust collectors.

I hope that the filter industry will be able to give to its customers and the users of its products technical performance data pertinent and applicable to a dust problem. Universal adoption of the AFI code in its present form will retard rather than accelerate the realization of this hope.—R. S. FARR, FARR CO.

W. T. VAN ORMAN —

"Code Is Not a Better Yardstick"

IN OUR PREVIOUS comments regarding the Air Filter Institute's proposed new code for testing air filters, we expressed the opinion that this code accomplished no useful purpose and would only add to the present confusion. In answering these comments, Messrs. Nutting and Logsdon bring up (in the September HPAC) some very fundamental considerations which go much deeper into the concepts of what an air filter is supposed to accomplish and the significance of evaluation methods.

Messrs. Nutting and Logsdon state that the AFI code meets the "need of a common yardstick for measuring the performance of unit viscous and dry type filters." It has always been our impression that air filters are used to remove particulate matter from the air and that their performance should be measured and determined by their effectiveness in removing atmospheric dust in toto and not only a coarse fraction thereof. In our opinion, this is a fundamental weakness of the AFI code. We agree with their statements that "there is no standard atmospheric dust" and this is why we have argued against the erroneous concept of a so-called "standard test dust." If there is no such thing as a standard atmosphere, then a "standard test dust" is equally untenable and inconceivable.

Messrs. Nutting and Logsdon try to defend the new code by stating that "the filters covered by Section I of the AFI code are not intended to be effective in removing discoloring particulate matter; indeed, most filters are not purchased for this purpose." That is indeed an amazing and astonishing statement. The facts are that most unit viscous and dry type filters are used in heating, ventilating and air conditioning systems for filtering air which contains not Arizona road dust but ordinary atmospheric dust containing a large amount of carbon in the form of highly dispersed smoke and soot. A study of atmospheric dust in 14 American cities made by the U.S.

Public Health Service in 1936 showed that the median size of the particles was 0.58 microns and only a small percentage of the particles were more than 1.5 microns in diameter. A chemical analysis showed the dust to consist of 65 percent carbonaceous matter and 35 percent ash. Filters are purchased to remove this dust from the air and for many years the manufacturers of unit viscous and dry type filters have told the American public that these filters would give air cleaning efficiencies as high as 92 percent and that they would "Keep your building clean."

A large percentage of the unit filters are used in heating and ventilating systems in homes and other buildings in the wintertime when the only problem is to remove smoke and soot from the air and the public has been told that these filters will accomplish this purpose. We agree that this is not the case and that the efficiencies are "uniformly low and difficult to evaluate" and that the use of discoloration tests for evaluating these filters is "ridiculous." However, we are opposed to the adoption of a testing and evaluation procedure that is selected for the purpose of showing a high efficiency rating for filters which have a low efficiency in removing atmospheric dust.

Messrs. Nutting and Logsdon state that the "efficiency spreads for commercially available filters falling in the category covered by Section I of the code have been observed in the order of 50 to 90 percent." These same filters when tested against atmospheric dust would have efficiencies in the range of 0 to 10 percent.

The statement is made by Messrs. Nutting and Logsdon that "one of the primary aims in developing the code was that it should show a clear and unmistakable difference between good and poor filters." A filter that would be rated as "good" under this code for capturing the AFI test dust would not necessarily be of any value for the removal of another dust having different characteristics. How then can the AFI code rate filters as "good" or "poor" with any degree of significance? Would a filter rated at 90 percent efficiency by the new AFI code be 90 percent efficient in removing flour from the air in a bakery, or 90 percent efficient for removing coal dust from the air in a coal pulverizing plant? A filter rated as "good" under this code could be very poor under other conditions of use, and a filter rated as "poor" could be good under certain conditions. A rating of "good" under this code means good for removing the AFI test dust and nothing else. Certainly the mixture of Arizona road dust, carbon black and cotton linters selected for the test dust is not sufficiently like the average atmospheric dust or any other dust normally encountered as an atmospheric contaminant to justify such filter efficiency ratings as "good," "poor" or "inferior."

We most strongly oppose the use of any testing procedure that will classify a filter as "good," or as having an efficiency rating of 50 to 90 percent when such filter actually has an efficiency of only 0 to 10 percent in removing ordinary everyday atmospheric dust. As previously stated, this would only add to the confusion.

We stated in our previous comments on the AFI code that "the carbon black tends to adhere to the particles of Arizona road test dust, making these particles larger in size and more easily captured." An attempt to discount this statement as an opinion rather than fact was made by citing the data in the following first two columns:

AFI data		
Arrestance of clean filter av. 4 runs	Description of test dust	Comparison by volume in cu in. of test dust picked up
60.7%	74% Arizona road dust fine 26% K-1 carbon black	28.4
75.2%	Arizona road dust fine	22.8

We have translated the data given in terms of weight into volume starting with 1 lb of test dust, and show the comparable volumes in the third column.

The makers of K-1 carbon black state that 1 lb has a volume of 96 cu in. One pound of the Arizona road dust has a volume of 30.4 cu in. The conclusion from the above data is obvious — even though less weight has been captured in the K-1 carbon black, Arizona road dust mixture, actually 20 percent greater volume than the plain Arizona road dust has been captured.

"We need more rigorous tests instead of easier ones" is our plea. We can see no advantages in the AFI code when it is not sufficiently different from the ASHVE code to produce appreciably different results. For example, viscous filters are rated at 72 percent efficiency on tests using the ASHVE code by one of the largest filter manufacturers and yet the data on the average three off-standard filters "X" tested by the committee that promulgated the AFI code showed 71 percent. The difference between 72 percent and 71 percent is tragically small. The engineering advances made in the 20 years since the ASHVE code was formulated should make possible a better tool than the AFI code, which is merely a continuation of the old thinking, with resulting efficiencies which are not significant or factual.

We stated that the AFI test dust is certainly not representative of atmospheric dust. In the comments of Messrs. Nutting and Logsdon, we were told that the carbon in the air and the carbon in the AFI test dust are both carbon. True. Coal and diamonds are both carbon but the comparison ends there.

We were told the carbon in the air and the K-1 carbon both have low bulk densities. True. Carbon in the air floats miles, K-1 has no such floating power. Carbon in the air does not tend to clog viscous filter passages, it goes right through, whereas K-1 carbon clogs filters, as shown in the data cited previously.

We were told carbon in the air and K-1 carbon are both difficult to capture. Carbon in the air is indeed difficult to capture by viscous filters. However, the industry with which we are associated used 1,363,297,000 lb of carbon black in 1952. This amazing poundage of carbon black, most of which was captured from the air in the process of manufacture, bears testimony to how easy it is to capture manufactured carbon black, contrasted to the pitiful amount of airborne carbon which "good" filters remove from the air.

Carbon in the air and K-1 are both carbon, yet different as day and night in their behavior. There is no justification in deluding the filter buyer or engineer that he is given a better yardstick for measuring the airborne carbon removing characteristics of a filter by the addition of carbon black to Arizona road dust.

In conclusion, it seems to us that the ASHVE committee on research would certainly be quick to accept the new AFI code if it were better, but it now stands rejected.—W. T. Van Orman, In charge of Air Filter Research, Goodyear Tire & Rubber Co.

COPPER

where it counts!

Winters get mighty cold in Bradford, Vermont. So if you want to keep "comfy" you've got to have an adequate and reliable heating system. That's why, when the Bradford Veneer & Panel Co., Inc., built their plywood mill office they used radiant panel heating. And reliability was also the reason they chose Revere Copper Water Tube for their radiant heating system.

The radiant floor panel system is a one-zone affair with a converter, so that steam from the main factory can be used. There were 1,120 feet of Revere Copper Water Tube used in sizes of 1"—1¼"—1½" and 2".

Keep out of trouble with copper. Use Revere Copper Water Tube for radiant panel heating, hot and cold water lines, underground service lines, air conditioning and processing lines, waste stack and vent lines. See the Revere Distributor nearest you today. And, if you have technical problems, he will put you in touch with Revere's Technical Advisory Service.

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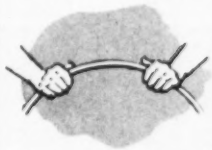
WHY REVERE COPPER WATER TUBE IS PREFERRED BY—

Architects, Builders, Plumbing & Heating Contractors



EASY TO BEND

Saves Time

Revere Copper Water Tube is easy to bend. Soft temper can be bent by hand to meet installation conditions.

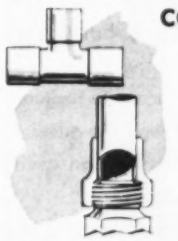
HANDY LENGTHS

Save Fittings . . . Labor

Revere Copper Water Tube comes in straight lengths of 20' in hard and soft tempers. 60' coils of soft temper reduce the number of fittings needed.

SOLDER OR COMPRESSION FITTINGS

Need Less Work Room . . . Save Metal

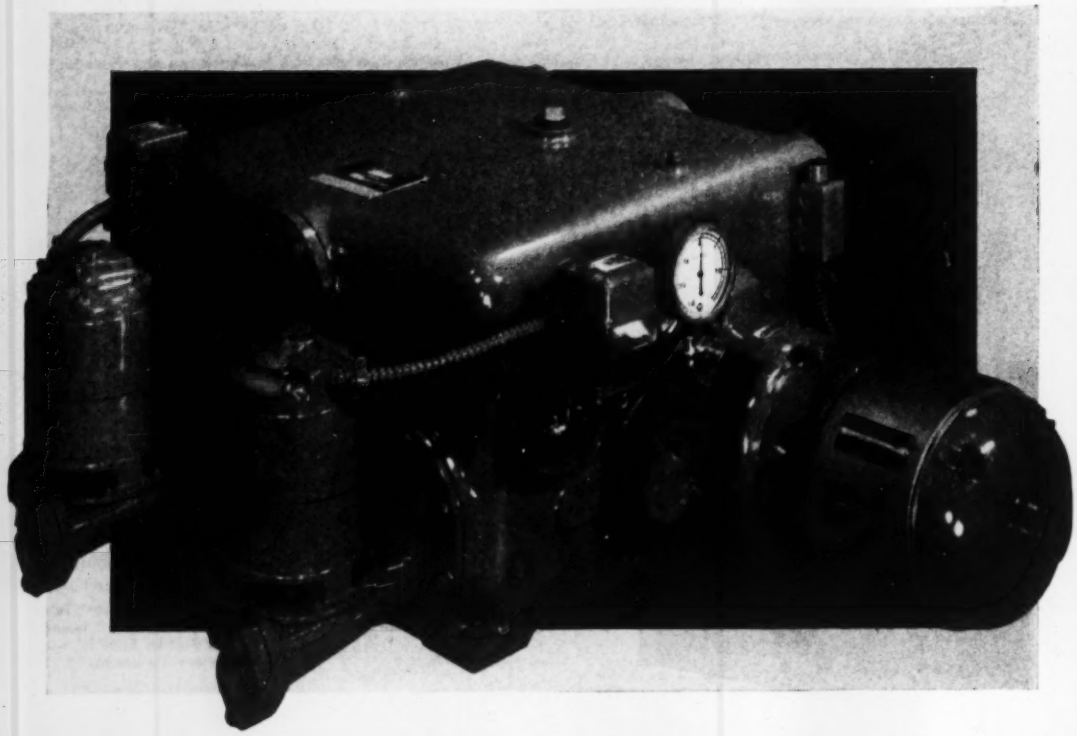


No worry about wrench room when you use Revere Copper Water Tube with solder fittings. Compression fittings can also be used. No threading is necessary with either type fitting. Wall thickness of tube used can thus be less than for threaded pipe.

NON-RUSTING

Rustable pipe eventually clogs as shown in drawing at top right. Non-rustable Revere Copper Water Tube suffers no loss of flow or pressure as shown at bottom right. No allowance in pipe size need be made for rust accumulation with Revere Copper Water Tube.

THIS NEW VACUUM HEATING PUMP
IS SIZED TO ACTUAL JOB REQUIREMENTS



It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
438 WILSON, SO. NORWALK, CONN.

Unique Piping System

. . . permits airplane fuel tanks to be sealed safely

By L. E. Hurd and J. E. Denton

A UNIQUE fill and drain system for sealing the interior of large airplane fuel tanks has been designed to increase production, reduce costs and provide a maximum degree of safety to operating personnel during the process. The system was designed for the Douglas Aircraft Co. for use in its giant cargo and troop transport, the Globemaster, now in production for the U.S. Air Force. The system employs an enclosed method of pumping the sealing compound into and from each of the twelve tanks which are located in the wing center section, six on each side, with a total capacity of 11,000 gal. As a result of this filling and draining process, the interior surfaces of the wing tanks are completely coated with the sealing compound.

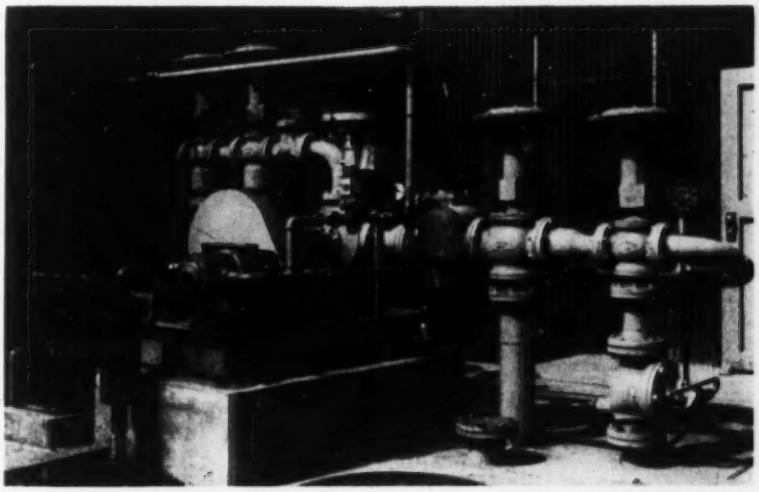
Old Method Hazardous

The previous method of sealing the wing tanks involved hand brush coating of the interior surfaces, a method which was extremely hazardous to personnel due to the inflammable and noxious nature of the sealing compound. This situation made it necessary for personnel to wear respirators during the process since the brush coating was applied on the inside of the tanks. It is estimated that the new method will reduce the production time by 300 man-hours per wing assembly.

In general, the new fill and drain system consists of pumping a sealing compound through an enclosed piping system to and from the various wing tanks of a complete wing assembly which is transported on a rolling dolly into the sealing booth enclosure. Each wing assembly of the airplane uses about 50 gal of sealing compound. After each tank is drained, warm air at 90 F is introduced into the tank to speed the drying process of the sealing compound. The filling and draining process is completed in approximately 2 hr, and the drying process requires about 5 hr.

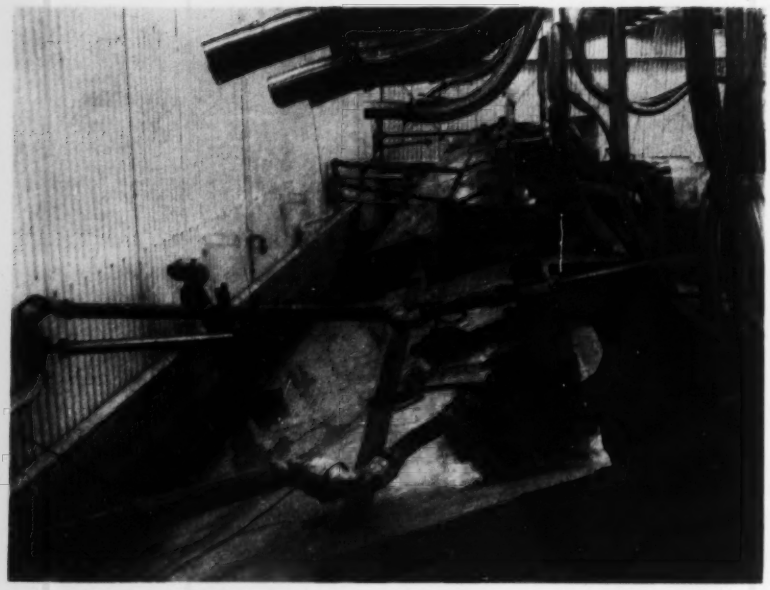
The sealing compound, designated as EC-776, has a synthetic

Messrs. Hurd and Denton designed the mechanical features of the fill and drain system for the Douglas Aircraft Co., Inc. They have had considerable experience as consulting engineers with particular emphasis in the air conditioning and process piping fields. Mr. Hurd is a Consulting Engineer, and Mr. Denton is a Mechanical Engineer with Van Dyke and Barnes, Architect and Engineer.

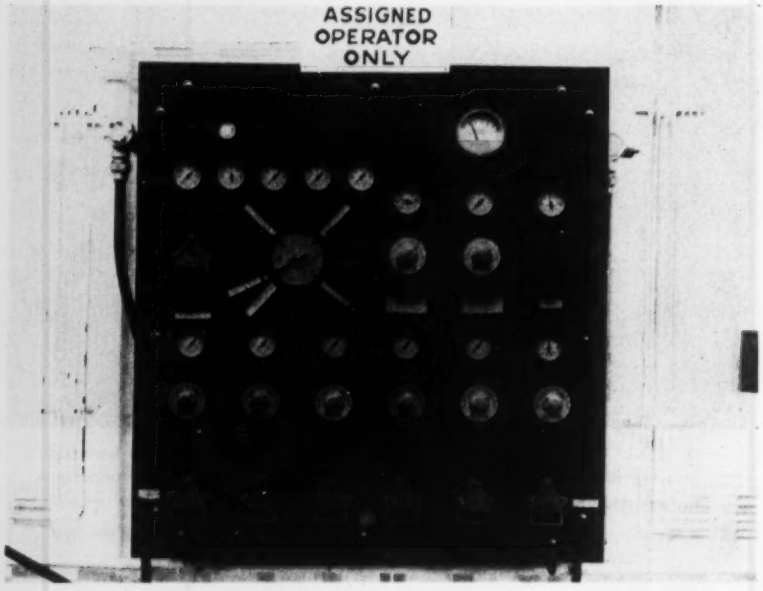


1 AIR MOTOR DRIVEN fill and drain pump and remotely operated valves are located outside of the fire resistant booth. The sealing compound is pumped to and from the wing tanks

2 FILL AND DRAIN supply and return lines are connected to underside of wing tanks. Warm air flexible ducts are elevated for future connection to tank openings in front of wing section



3 WING ASSEMBLY is in place with overflow tank adaptor fittings connected. Flexible ducts are connected at the front of the wing — others are elevated for future connection to the adaptor fittings on the top



4 PNEUMATICALLY OPERATED CONTROL system provides for remote operation of all valves and pumps at the system control panel, which is located inside the fire resistant booth

rubber base with methyl isobutyl ketone (MIBK) as the solvent. The MIBK is generally added to EC-776 to reduce the solids content to 20.2 percent. The resultant sealing compound has a viscosity of thin syrup and is inflammable in the wet state, having an open cup flash point of 70 F. The vapors from this compound are noxious; consequently care must be taken to avoid breathing the vapors.

Fire Resistant Booth

Because of the hazardous nature of the EC-776 and MIBK, fire department authorities required the construction of a special two hr fire resistant booth enclosure, 40 ft wide and 120 ft long, to house the entire process. All equipment and piping inside the enclosure is grounded to prevent static sparking. The process piping, and all ductwork for the warm air purging system, are completely enclosed to prevent the escape of hazardous vapors into the enclosure.

The enclosure is heated and ventilated by a ductwork extension from the existing heating system of the large assembly building which contains the booth enclosure. All of the air supplied to the room is exhausted to the outdoors by a separate blower, with the exhaust grilles located high and low in the enclosure.

In order to reduce the fire hazard within the enclosure, the sealing compound and solvent are stored in the underground storage tanks located outside the enclosure. The fill and drain pump of 200 gpm capacity is located outside and adjacent to the storage tanks. It is utilized for pumping the EC-776 to and from the wing tanks and for circulating MIBK through the piping at specified intervals to dissolve any EC-776 which may have dried inside the pipe lines. An additional 200 gpm pump (transfer pump) located inside the booth enclosure is utilized for transferring EC-776 from one wing tank to the next after filling the first two inboard tanks by the fill and drain pump.

How It's Done

The general procedure for filling the wing tanks of the airplane consists of filling the two inboard tanks at the same time, using the fill and drain pump. The remaining outboard tanks on each side of the center wing section are filled consecutively using the transfer pump to transfer the EC-776 from each inboard tank to the adjacent outboard tanks.

In order to reduce the fire hazard it is essential that the total quantity of EC-776 contained in the wing assembly at any instant during the process, shall not exceed the capacity of the two largest wing tanks. If a quantity of EC-776 remains in an inboard tank because of its larger capacity than the adjacent outboard tank, the fill and drain pump is used to pump the excess EC-776 back to the underground storage tank.

Control System

A pneumatically operated control system is the heart of the fill and drain system. It provides for the remote operation of all valves and pumps at the system control panel which is located inside the booth en-

closure. With the operation of a single switch at this panel, the operator is able to position five 3-way pneumatically operated valves outside the enclosure for selecting one of the following flow processes:

1) Supply sealing compound (EC-776) to wing tanks.

2) Return sealing compound (EC-776) to storage tank.

3) Circulate solvent (MIBK) through pipe lines to dissolve any dried compound.

4) Return solvent to storage tank.

5) Circulate sealing compound in the storage tank to prevent settling of the solids.

After one of the above flow processes has been selected, the operation of the fill and drain pump will start the process. In the event that one or more of the 3-way valves are not positioned correctly due to a failure in the pneumatic control system, or in the mechanical operation of the valves, a corresponding light at the panel fails to go on, indicating that trouble exists. The lights are activated by explosion proof switches attached to the stem of each 3-way valve.

Transfer System

Transfer of sealing compound from inboard to outboard tanks is accomplished by the remote operation of wing tank supply and transfer valves which control the flow to individual wing tank supply booms inside the enclosure, and the remote operation of the transfer pump.

In order to reduce the fire hazard and to provide an economical method of speed control, pneumatically operated air motors are utilized as the prime movers for the fill and drain and transfer pumps. By the use of gradual air switches at the system control panel, the operator is able to reduce the pumping rate of the compound or solvent to any desired quantity.

Flexible Piping, Ducts

Piping connections on each wing tank are made by the use of flexible supply and overflow booms fabricated from standard pipe and special swing joints. Attachment to each tank is made by the use of quick couplers attached to special tank adaptor fittings which were designed for this system.

During the wing tank drying process, outside air heated to 90 F is supplied and exhausted from the wing tanks through an enclosed duct system, utilizing separate supply and exhaust blowers. Duct connections to each tank are made by the use of flexible aluminum tubing attached to openings in each wing tank.

The entire fill and drain project was under the direction of Kenneth R. Waltz, Plant Engineering Supervisor, Long Beach Div. of Douglas Aircraft. He was assisted by James Turrentine. All of the mechanical work was installed by the Southern Engineering and Construction Co. at a cost of approximately $45,000. The entire project, including the 40 ft x 120 ft booth enclosure, space heating and ventilating, plumbing and the fill and drain system, cost approximately $130,000.

Here's Air Conditioned "Construction Shack Deluxe"

TEMPORARY CONSTRUCTION shacks are often veritable "sweat boxes" in the summertime — particularly in the southern parts of the country.

Patrick Lyons, president of the Lyons Construction Co., Miami, decided upon a profitable and comfortable solution to this problem. He bought an obsolete bus from a local transport company and went to work to make it an ideal field office. All seats except the driver's were removed and asphalt tile flooring was installed. Light plywood desks and filing cabinets were built in. The interior was painted a light green and the outside was painted white. The windows were equipped with awnings. Good lighting was put in for night work, and comfortable chairs and a lounge for visitors make the office as pleasant as any downtown.

The final addition was a ¾ ton room air conditioner, which was inserted in one of the bus windows.

The result is a field office with a smart, businesslike appearance and year 'round comfort. Mr. Lyons believes this innovation has already paid for itself in improved quality and quantity of work done by himself and his staff. Total cost of the bus and the expense of equipping it was little more than that of a couple of the ordinary frame shacks. He now has a permanent office which can be readily moved from one job to another under its own power. This also saves the delay and confusion of moving office equipment, records, etc., every time a new job is started.

AN OBSOLETE BUS was transformed into a contractor's field office with complete facilities, including an air conditioner

Study Unsteady Pressures in Pipe Lines

THE PHENOMENA of unsteady pressures in pipe lines are being studied at the Oklahoma Institute of Technology, at Stillwater. The theoretical analysis and testing of a laboratory model have been completed, and a pilot pipe line to more nearly approach field conditions is being constructed, according to E. J. Waller, assistant project leader.

Says We Must Increase Industrial Productivity

INDUSTRY MUST improve its productivity if America is to support its population of 200 million persons expected by the end of the century, Dr. John T. Rettaliata, president of Illinois Institute of Technology, said at a banquet of the National Conference on Industrial Hydraulics in Chicago last month.

"In all probability," he said, "a work week of 30 hours or less will materialize well before the end of the century. Thus, we are faced with the problem of satisfying the demands of an expanding economy for a greater flow of goods at the same time that the people producing the goods are working fewer hours."

This poses a neat problem, he said, and the only solution is to increase output per man-hour. "Only an advancing technology can accomplish the miracle required and give men more goods with less work," he said.

"THE EQUIPMENT selected was of the best, yet when the plant was finally put in service, it was noticed that several important things were missing."

"IN FACT, air conditioning is practically a must in such places as stores, restaurants, theaters, hotels, clubs, offices, and many other buildings."

CASE HISTORIES SHOW:

How NOT To Air Condition

By C. T. Baker
Consulting Engineer

• The ever-increasing acceptance and demand for air conditioning in almost all types of buildings make it even more important today that all installations be properly engineered and correctly installed. Low first cost should never be achieved by sacrificing the quality of the job.

An experienced and well-known consulting engineer digs into his files for some "case histories" to illustrate the point. His comments are intended to draw attention to mistakes which have been made — and thereby to prevent repeating them on future installations.

AIR CONDITIONING for human comfort has long since created for itself its "place in the sun." The public recognizes and appreciates the value of comfort cooling. In fact, it is practically a "must" in such public places as theaters, hotels, clubs, restaurants, stores, etc., and lately, churches, offices, etc., have been included in this list. Many homes are being air conditioned, too, and it now appears that air conditioned automobiles will soon be common.

These and the many other useful applications of mechanical refrigeration for the comfort of man spell progress. The many thousands of successful plants to be found in all parts of the United States are undisputed evidence that the industry, as a whole, has done an outstanding job in serving the public.

In view of this wide public acceptance of air conditioning, it is unfortunate that the industry should at times come under the cloud that casts shadows on the just and unjust alike. Some practices fail to reflect credit on the industry, are responsible for failures of air conditioning installations to give completely satisfactory and trouble-free service.

Whether we want to admit it or not, there are owners who are critical of air conditioning and dissatisfied with their investment in the installation. Recently, a business executive, who was trying to get his plant to do what it was "sold" to do, told me he thought that "air conditioning has become a racket." That one particular individual has done a lot of talking since — advising his friends in business to go slow, to stop, look and listen, before signing any air conditioning contract.

Cuts More Than the Price

It so happens in this case that the buyer himself was largely responsible for the trouble that he was experiencing with his installation. In asking for bids, he said that he wanted to air condition his offices but that he didn't want to spend much money. He received several proposals and the one submitted by the low bidder was selected on that basis alone. The man was not financially responsible, nor was he qualified to design and install air conditioning systems, in my opinion.

I know of other such instances where failure to perform resulted from the desire for air conditioning but an unwillingness to pay for it. You often run across the sharp trader who tells each prospective bidder, "I would rather do business with your company. They are fine people. But your price is way out of line. Can't you cut it down some?"

Usually, some one does cut, but as a rule he cuts more than the price. He has to, or lose money on the deal. However, the puzzle is, why should anyone even bargain with people who demonstrate from the beginning that they are merely chiselers?

There are cases, too, where the contractor has done some "short circuiting" on his own hook. The following case histories illustrate that the buyer sometimes fails to receive all he is entitled to.

Important Items Missing

A 50 ton job was bought on speci-

Mr. Baker, consulting engineer specializing in air conditioning, refrigeration and power, draws upon cases from his wide experience to cite examples of "what not to do" in the design and installation of air conditioning systems.

fications prepared by the architects who developed plans covering extensive additions to a public institution. The equipment selected was of the best, yet when the plant was finally placed in service, it was noticed that several very important things were missing.

For example, there was a total of only three valves in the entire system, other than the thermal expansion valve and one solenoid valve. Two of the three valves were the stop valves at the compressor — one on the suction inlet and another on the discharge outlet. The third was on the liquid outlet of the receiver. The liquid refrigerant dryer had been installed without benefit of a properly valved bypass, which meant that when and if the drying material was ever changed, much of the piping system would be exposed to the entrance of air and moisture.

Two pressure gages were included, one on the discharge outlet of the compressor and the other on the suction inlet. Both gages were installed at the compressor where they were subject to machine and pipe vibration. It was but a few days until both of these gages were so far out of calibration that they could not possibly reflect true suction and discharge pressures.

In one section of the suction line, the dew point temperature was below that of the surrounding air, which kept the floor below wet most of the time — because the exposed line was not insulated. Said the contractor: "The architect's specifications didn't call for these things and I don't aim to furnish anything that isn't called for."

So far as capacity is concerned there is no complaint — the system has very satisfactorily cooled the many rooms of the building extension and the contractor considers that he has fulfilled his responsibility. He says: "I promised to cool the building — that I have done! It's not my business to say what to install."

Water Chiller Freezes

The shell and tube water chiller used to cool water for circulation in a central air conditioning system froze; several tubes were split and most of the "Freon 12" was lost. The reason?—failure to provide a positive automatic cut-out to stop the compressor before the temperature of the chilled water reached the freezing point.

True, there was a constant pressure valve on the suction outlet of the chiller — intended to prevent the evaporating pressure from dropping low enough to cause freezing — but since there was no pressure gage between the chiller and the valve to indicate at what pressure the valve was set, it was assumed that the setting was what it should be since "it came from the factory that way!"

It developed later that this valve was not properly adjusted and that low suction pressures were possible under certain conditions that were not unusual in this installation. The equipment was installed under a contract that went to the low bidder.

No Room for Maintenance

In this air conditioning plant the shell and tube tube condenser held the condensing pressure to satisfactory limits for the first season's operation. But the pattern changed during the latter part of the second season when the concentration of soluble solids in the cooling tower basin, plus algae growth, stopped up the condenser tubes.

Before these tubes could be cleaned, the condenser had to be disconnected and removed from the building. Why? — because there was only 18 in. of clearance between one end of the condenser and a concrete wall and 24 in. at the other end. In addition, conditions would not permit a hole to be cut in either wall to allow room for the use of a tube cleaner.

Queried the owner: "Why did the contractor install the condenser there? He knew at the time that it could not possibly be cleaned between those two walls." The contractor contended, however, that he "put it where the man said to put it." In this instance, it seems to me that both the buyer and the seller were to blame. Neither exhibited much forethought in consenting to this type of installation.

Yes, the condenser was re-located at the close of the air conditioning season. The cooling tower basin was emptied and cleaned and a continuous drain was provided to prevent excessive concentration of soluble solids thrown down by evaporation. Before the next season, the water was treated to prevent algae growth.

Provide Ventilation

A common complaint of customers in drug stores, restaurants, ticket offices and other places frequented by the public is stale, recirculated air — full of odors and tobacco smoke — perhaps delivered by a swanky appearing packaged unit that is against the wall in a corner of the room. The unit cools and recirculates the air of the enclosure, but has no provision for bringing in outside air for ventilation, or for adequate dehumidification.

Practices of this sort leave much to be desired in the way of a finished product — that is, really conditioned air. The buyer can well afford to spend a little more for a unit or central system large enough to cool and condition sufficient outside air to keep the place properly ventilated. The notion that the opening and closing of doors will provide air change sufficient for adequate ventilation in spaces of this kind is a snare and a delusion, in my experience.

Should Have Gages

Inspection of many air conditioning plants — fairly large ones included — will too often disclose the complete absence of pressure gages. Seeking the answer, you may learn that "pressure gages are unnecessary," that "if you want to know what your pressures are, we'll send a serviceman to check them for you." Too often, however, the gages carried by servicemen are far from accurate. So, after all, you really don't have anything when you buy gage reading service unless you can be absolutely sure that the gages used are accurate.

A wall type gage board fitted with a high and low pressure gage, protected by snubbers, will add only a few dollars to the purchase price, for example. Properly installed, such gages are on duty 24 hr a day and you won't require a serviceman to tell you what the pressures are.

Mustn't Be Noisy

Quiet operation is generally one of the first things that the management of a business catering to the public insists on in contracting for air conditioning. This is particularly essential in the case of hotel guest rooms. Yet, a certain hotel, whose widely scattered billboards proclaim that all rooms are air con-

ditioned — which is true — neglects to tell the prospective guest that the cooling equipment is so placed that a sounding board effect is produced whenever in operation. To be sure of a restful and noise-free sleep, it is necessary to shut off the equipment upon retiring. This oversight is correctly chargeable to the designer of the building and not to the air conditioning and heating contractor. The company that leases and operates the hotel gets plenty of complaints from their guests because of the excessive noise.

Another interesting feature of this system is the layout of the cold water distribution piping system. A pump in the basement circulates cold water from the water chiller to the rooms of the multi-story building. There are no valves on the inlet and outlet water connections of the room cooling units; likewise, no valves were placed on the various floor feeder lines to permit the water to be shut off in case of emergency. As a matter of fact, only two stop valves were provided in the entire system — one on the inlet and the other on the outlet connection of the water chiller.

Some day — or night — a failure will occur somewhere in the thousands of feet of water piping, and with no shut-off valves to stop the free flow of chilled water the property and liability damages will be sufficient to pay for many times over the number of valves needed. The heating and air conditioning contractor told me that no valves were called for in the specifications.

Big Fans Ventilate New Pittsburgh Tunnel

A TECHNICIAN adjusts an oil gage on one of the 250 hp fans that provide fresh air for motorists driving through the new Squirrel Hill tunnel in Pittsburgh. (Photo courtesy Westinghouse Sturtevant Div.)

ONE MORE LINK in Pittsburgh's redevelopment program was completed recently when the Penn-Lincoln parkway Squirrel Hill tunnels were opened to traffic. Eight fans provide 1,900,000 cfm of fresh air to the new 4225 ft long tunnels.

The tunnels consist of twin tubes of two lanes each with a barrier wall separating east and westbound traffic. Two blower and two exhaust fans are located in ventilation buildings at each end of the tunnel. With low to average traffic loads, only two fans are used to ventilate each tunnel. The additional four fans are put into action only during morning and evening rush hours or in emergencies. The motors driving the fans have a combined capacity of 1350 hp. The two motors that drive each fan are connected and geared together to provide three-speed operation.

In normal operation of the tunnels, air is drawn from the outside and blown through a duct running the length of the tunnel above the ceiling of the vehicular roadway. At 15 ft intervals along this ceiling, there are open slots that permit the fresh air in the duct to be blown into the tunnel proper. A solid bulkhead halfway through the duct assures that all air flowing through the duct is forced down through the open slots.

At the opposite end of each tunnel, another fan does the same air moving job in reverse. Used air from the far half of the tunnel is drawn up through the slots, into the duct and exhausted by the fans up a vertical stack.

Every possible precaution has been taken in case of a fire within the tunnel. Setting off any of 16 manually operated fire alarm stations in each tunnel immediately flashes a red light at the entrance of the tunnel, stopping incoming traffic. Simultaneously, the location of the fire is indicated on the control board of the fan operator. Gates are electrically adjusted in the duct passages permitting additional fans to exhaust the affected tunnel. With fans at each end of the tunnel turning at high speed and exhausting fumes and smoke, fresh air is rapidly drawn in through both entrances, protecting passengers in stopped cars and permitting fire equipment to move through the smoke cleared passages.

When the entire Penn-Lincoln parkway is opened — sometime in 1958 — vehicles will be able to enter the limited access, high speed artery 10 miles east of Pittsburgh, travel through the heart of Pittsburgh, and leave the parkway nine miles west of the city.

ASTM Approves New Specifications

THE AMERICAN Society for Testing Materials, 1916 Race St., Philadelphia 3 — through its administrative committee on standards — has recently approved a number of new specifications and test methods, as well as revisions in existing standards.

Among the new methods of test are:

API Gravity of Petroleum and Its Products by Hydrometer (D 287-53 T).

Specific Gravity of Petroleum and Its Products by Hydrometer (D 1298-53 T).

Chlorine Requirements of Industrial Water and Industrial Waste Water (D 1291-53 T).

Odor of Industrial Waste Water (D 1292-53 T).

Determination of pH of Industrial Waste Water (D 1293-53 T).

Among the revised tentative specifications are:

Wrought Seamless Copper and Copper Alloy Pipe and Tube (B 251-52 T).

Extra Strength Clay Pipe (C 200-50 T).

Asbestos — Cement Corrugated Sheets (C 221-49 T).

Asbestos — Cement Pressure Pipe (C 296-52 T).

Tentative revisions of standards include:

Seamless Copper Water Tube (B 88-51).

Seamless Brass Tube (B 135-52).

Copper Alloy Condenser Tube Plates (B171-52).

ASTM Thermometers (including tentative additions) (E 1-53).

Definitions of Terms Relating to Thermal Insulating Materials (C 168-51).

THE GREATEST "COST LEAK" in hospitals is predominantly in the mechanical plant, says Mr. Neergaard

Hospital Costs Reduced

. . . by use of insulation and double glazing

By Charles F. Neergaard

Neergaard, Agnew, Craig and Westermann
Hospital Consultants
New York and Toronto

SEVERAL WAYS TO SAVE

Important economies in hospital costs can be achieved without reducing the efficiency or reliability of the mechanical installations, says Mr. Neergaard. One of them — discussed this month — is the better use of thermal insulation and double glazing. Other methods will be outlined in future articles by Mr. Neergaard, a well-known hospital consultant with many years of practical experience.

ENORMOUS IMPROVEMENTS in planning, building, equipping and operating hospitals have taken place in the last 25 years. However, it is believed that the cost for mechanical equipment can be reduced further and that the cost of heating hospitals can also be lowered.

Equipment Oversized

Back in 1915 a widely experienced hospital engineer recommended that three 150 hp boilers be installed for a 100 bed hospital. It was suggested by another engineer with no hospital experience that for the building under consideration a 100 hp boiler with a 100 hp standby would be sufficient to carry the winter load. The recommendation of the engineer with no hospital experience was followed and the two 100 hp boilers have given satisfactory service for 38 years.

Even in present-day practice, many installations are being overdesigned with equipment that is either too large or not designed for the job. This situation is due in some part to the lack of complete understanding by architects and engineers as to what the comfort and safety requirements are for the patient and hospital personnel. Perhaps this lack of understanding stems from the fact that hospital management has rarely had a careful scientific analysis of the precise heat and power requirements.

Lower the Cost

If our hospitals are to maintain their standards, they must find ways

to cut their operating budgets — and the greatest leak is predominantly in the mechanical plant. There is a not difficult-to-find reason for this. An architect who has the responsibility of designing a hospital may recommend an engineer to specify the mechanical and equipment details for the new structure, who has a long list of hospitals to his credit. This is not necessarily bad, but unless he chooses with care, he may bring to the job an engineer who almost automatically specifies that the boiler capacity, radiation area, breakdown reserve, automatic controls and other mechanical equipment be oversized.

The criterion for choice of engineers should not be the number of hospitals they have worked on, but how functionally and economically the institutions have operated after they have been put in service. It is true, of course, that figures to establish the performance efficiency of a hospital are difficult to arrive at. However, in the case of mechanical equipment for heating, ventilating, steam production and cooling, cost figures are not too difficult to get, and some are presented in Tables 1 and 2. Provided the data are carefully adjusted for regional differentials in fuel prices and for different seasonal heating requirements in terms of necessary degree days for heating (and perhaps for cooling), these figures can establish the relative operating economy of specific installations, and thus give some notion of the skill of the engineers who planned them and supervised their construction and initial operation.

Weatherproof the Building

One of the common methods for reducing the cost of the mechanical equipment is the complete weatherproofing of the structure by the use of insulation and double glazing. Of course this should be included in the plans and specifications for the building so that the selection of the mechanical equipment will be made on this basis. What the architect and engineer embody in their plans and specifications establishes the operating economies for the life of the building. Comparison of the costs given in Tables 1 and 2 readily indicates the value of insulation.

In 1947, a certain group of 36 hospitals, with an aggregate of 6900 beds, spent $1,770,000 for power, light and heat, or an average of $256 per bed. If these plants were built today with the same capacity and were properly insulated and engineered, the annual cost would only be about $100 per bed — a potential saving, at 1947 prices, of over $1,100,000 a year.

Insulation and double glazing are the most profitable long-term investments a hospital or any other building can make from the point of view of reducing the installation and operation costs of the mechanical plant. I have been fighting this battle for thorough insulation of hospital structures ever since the mid-1930's, when I was a member of the design and engineering team that built the first (and for a long time the only) multistoried steel frame building in the East in which the roof and walls were completely insulated, and the windows were double glazed. This was the Washington County hospital, in Hagerstown, Md.

The case of this hospital and its remarkable experience record has been cited many times in the past 15 years, and it is beginning to become ancient history from my point of view. Nevertheless, the story is of such basic importance in the whole modern problem of efficient hospital design that it is worthwhile to resummarize a few of the technical details here.

Value of Double Glazing

The hospital has walls comprised of a 12 in. brick curtain wall, a 2 in. air space, a lightweight 3 in. thick fireproofed fiber-and-cement furring block — 20 by 30 in., and ½ in. of plaster applied directly to the blocks. The heat loss coefficient for the wall is 0.107 Btu per sq ft per hr. While the cost of the block was higher than other materials, it took a third less time to lay up, which in turn resulted in a considerable saving in labor costs.

The windows were glazed with a prototype of today's prefabricated double glazing, at a cost of around $2.50 per sq ft installed. Double strength glass then cost around 35c for similar pane sizes, so that the sq ft increase in cost was a net $2.15, plus 10c for extra labor charges, or around $2.25. Incidentally, double glazing can be made of double-strength glass today for not far from the same installed price that was paid for double glazing before the war.

The result of this complete weatherproofing of the hospital was a saving in boiler, piping and radiator sizes sufficient to offset the additional costs of the insulating blocks and the double glazing, except for a very small amount that was made up by the lower fuel consumption rates during the first two seasons of operation. Thereafter the low fuel

TABLE 1—HEATING AND TOTAL COSTS for hospitals with all or a portion of the buildings insulated

Location	No. beds	Days care	Total cost	Power, light and heat cost: Per bed per yr	Power, light and heat cost: Patient per diem	Proportion insulated
Toronto, Ont.	547	175,488	$40,622	$ 74	$0.23	½
Prince Edward Island, Canada	200	54,037	19,373	97	.36	All
Hagerstown, Md.	170	57,783	27,718	163	.48	½
Glen Falls, N.Y.	162	59,208	19,048	117	.32	½
Bethlehem, Pa.	307	89,001	58,153	188	.65	¼

TABLE 2—HEATING AND TOTAL COSTS for hospitals with none of the buildings insulated

Location	No. beds	Days care	Total cost	Power, light, and heat cost: Per bed per yr	Power, light, and heat cost: Patient per diem
New York City	520	152,686	$163,129	$314	$1.07
Brooklyn	341	96,966	117,897	346	1.22
New Jersey	284	71,856	71,367	251	.99
Long Island	236	69,040	77,023	326	1.12
Central New York State	218	66,323	43,509	200	.66
New Jersey	207	56,588	65,317	316	1.16
Northern New York State	150	41,959	27,828	186	.66
New York City	131	29,741	58,541	447	1.97
Connecticut	134	36,157	43,130	322	1.19
Long Island	110	32,843	36,775	334	1.12
Westchester County, N.Y.	100	28,261	33,975	340	1.20
Brooklyn	143	30,288	43,875	307	1.45

These figures are from a group of hospitals with uniform accounting.

consumption created a sizable annual net saving for the hospital.

It is also worth noting that this insulated building proved to be 8 F cooler in the summer than a similar but uninsulated building on the same hospital grounds.

Value of Insulation

Another example of the values of insulation can be cited by referring to the 547 bed hospital in Canada, only half of whose buildings were insulated, which spent $40,600 for power, light and heat in 1947. In the same year, a 520 bed hospital in New York City, which was uninsulated, spent $162,000. Of course, part of the difference may have been due to higher fuel costs in New York, but it was very far indeed from being even a major part of the difference.

Tables 1 and 2 further substantiate the figures in this example.

Hospitals Now Insulated

For many years our firm had the only thoroughly insulated hospitals in the country to our credit, I believe, with most of them in Canada. Recently it was noted that one of the large manufacturers of double glazing has supplied over a hundred hospitals using anywhere from around 100 to 4600 double glazing units per hospital. They are located from Anchorage, Alaska, to Tallahassee, Fla., though most of them are in the central and northern United States where winter heating is the major problem.

Whether these hospitals also have adequate wall and roof insulation, and whether their boiler plants and radiator sizes have been suitably selected, is not known. It has been our experience that even when a hospital is thoroughly insulated throughout, the engineers on the job oftentimes fail to take into account the reduction in heat loss that results and continue to specify and install boiler and radiator capacity practically as if there were no insulation at all.

In this connection I would like to emphasize a very simple rule, based on experience with many installations, which was originally formulated by an old associate, C. E. Daniel, consulting engineer for the U.S. Public Health Service. When he was working on a precedent-setting series of articles on hospital planning, he included in the section on mechanical standards that appeared in a preliminary mimeographed version the following paragraph:

"Where the walls are well insulated, the size of the radiators and heating boilers can be reduced by approximately 25 percent. If, in addition to the insulation, the windows are double glazed with a sealed air space between the panes, the size of the radiators and heating boilers can be reduced 50 percent."

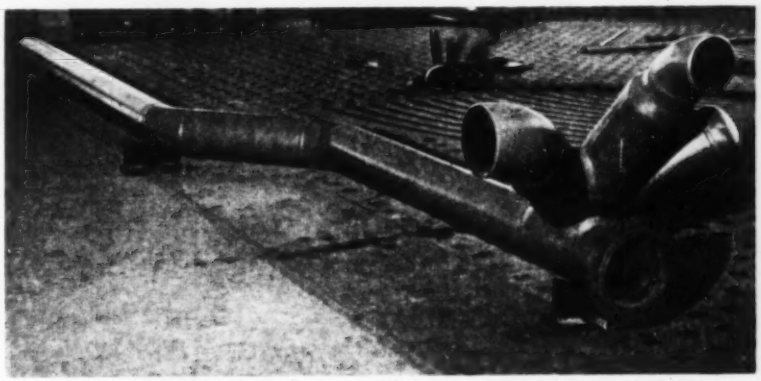
When the articles finally were published, however, these significant sentences were omitted, and in their place the following appeared.

"Considerable saving can be made in installation and operation costs of the heating system by insulating the exterior surfaces of the building, providing double glazing and weather stripping."

The reasons for this change in text have never been explained to me. The fact remains, however, that every experience our firm has had with insulated hospitals proved that Mr. Daniels' recommendations were sound and conservative.

In summary, although it seems that hospital insulation is gaining wider acceptance, at least in part, there is no present proof that the resultant reduction in heat loss is being suitably reflected in smaller mechanical plants. It is my hope that the engineering profession in general, will consistently urge the use of building insulation and double glazing in all major buildings, as a matter of national economy, and thereby cut fuel consumption in half.

[The author wishes to acknowledge and thank Groff Conklin for his help in preparing this article.]



THIS WELDED PIPING ASSEMBLY is part of the roof drain system for a new central power plant

Roof Drain Piping Welded

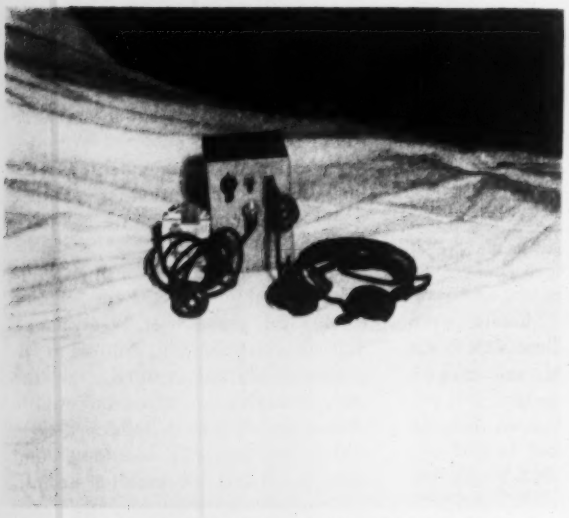
By G. W. Hauck
Manager, Engineering Sales
Crane Co.

PIPE WELDING is taken for granted today when thinking of high pressure piping or even intermediate and low pressure piping. However, when dealing with piping that is subjected to practically no pressure — such as roof drains — the advantages of welded construction are not always fully appreciated.

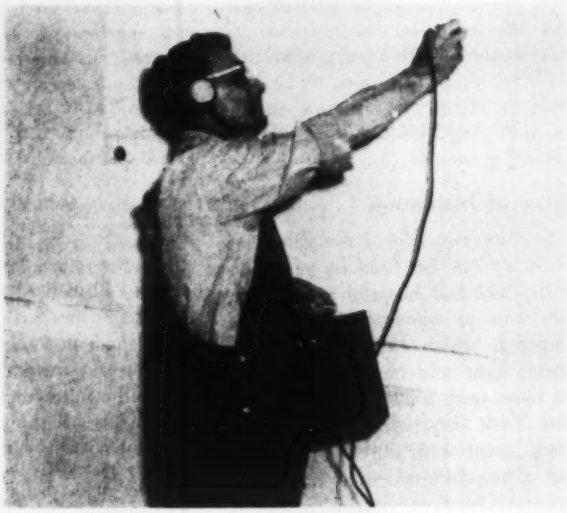
The welded piping assembly shown here is a part of the roof drain system of a new central power station. This assembly is a notable example of how pipe welding can be applied to this type of application. The main downcomer is 8 in., and the welded nozzle inlets are 8 in. and 6 in. The overall length of the assembly is about 21 ft, and it weighs 890 lb.

The photo almost tells its own story. However, a casual glance at this assembly can be deceptive. The angular nozzle welding of three inlets is not as simple as the streamlined appearance suggests. This type of fabrication involves tricky cutting, setup, alignments and welding techniques.

Using welded construction to its fullest extent, the designer of this piping system has combined multiple openings into a compact arrangement with far less weight and bulk than would have been possible otherwise.



1 THE MINIATURE METAL DETECTOR was designed and built especially for this installation for locating buried pipes and conduits at a depth of ¾ in. in the plaster



2 TO USE THE DETECTOR the operator puts the earphones on and passes the probe over the surface of the plaster wall along the path where he intends to cut the groove

New Technique Speeds

Oxygen Piping Installation

Metal detector shows where plaster can be grooved without encountering interference, and rotary cutter speeds the job of grooving. New technique used for installing central oxygen piping at Michael Reese hospital in Chicago

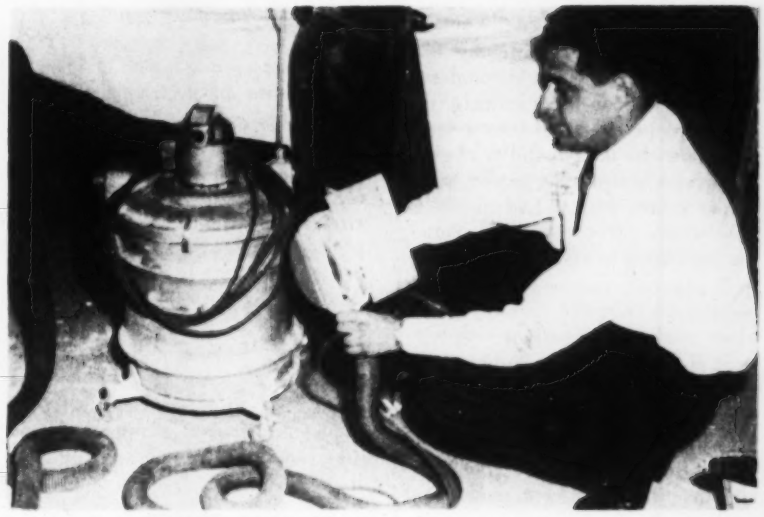
By Arthur Abrahamson, Engineer
Advance Heating and Air Conditioning Corp.

INSTALLING CENTRAL OXYGEN SYSTEMS in existing hospitals is considered a desirable modernization step — as many hospitals look toward keeping their facilities up to date. Not only does the central system eliminate the constant moving of bulky oxygen cylinders in patient rooms, but more important it assures an adequate supply of oxygen to all rooms without the complications of accounting for storage and distribution of the individual cylinders. The system usually consists of a manifold storage system with individual pipes extending to oxygen outlets in the patient rooms.

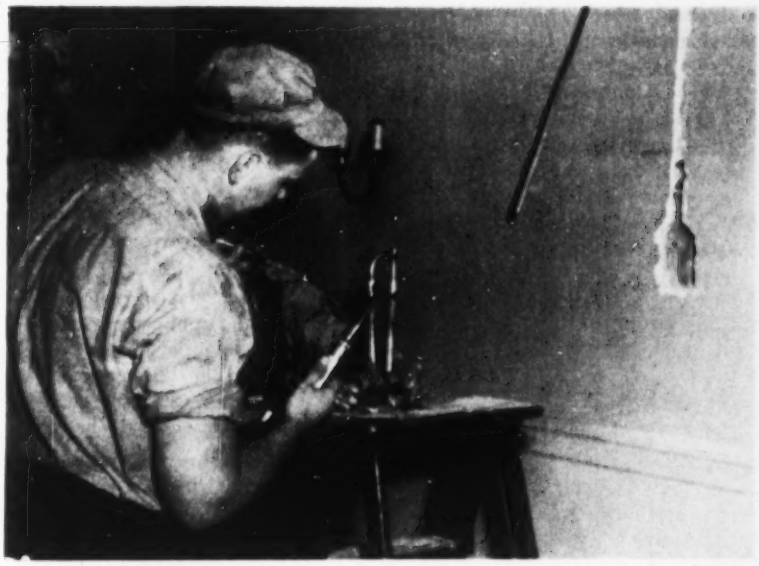
Many Problems

One of the many problems of installing a central oxygen system in an existing hospital faced by the piping contractor was that of finding a means to conceal the maze of piping. If this piping were openly exposed, particularly in the patient rooms, the pipes would cause an unsightly appearance. It seemed logical therefore, that the pipes should be embedded within the walls. The problems resolved into three major ones: (1) cutting a groove in plaster walls for the purpose of burying the copper tubing, (2) providing a practical means of collecting the plaster dust and debris resulting from cutting the groove, and (3) developing a means for locating

3 A PORTABLE POWER ROTARY CUTTER unit consisting of eight carbide tipped cutting bits was developed for grooving the plaster. The groove was about ⅝ in. wide and deep



4 A VACUUM CLEANER is connected to the air tight housing of the rotary cutter by a flexible rubber hose. Removal of the plaster dust was essential



5 ASSEMBLING AN OXYGEN OUTLET for installation in the wall after successfully grooving the plaster and installing the piping

electrical conduit and other piping that had been buried in the plaster previously.

Rotary Plaster Cutter

After much experimenting, a portable power rotary cutter unit was developed for this purpose by one of the manufacturers of oxygen equipment. It uses a cutter wheel consisting of eight carbide tipped cutting bits which cut into the highly abrasive plaster easily. After beginning the installation of over 300 outlets at Michael Reese hospital in Chicago, other methods were tried, including abrasive wheels, routers, and the channel by hand method. The last of these methods proved inacceptable because it was necessary to move with speed (hospital rooms being at a premium, the complete installation of outlet and individual piping had to be completed at the rate of about four single unit rooms per day). The methods other than the rotary cutter proved impractical due to the abrasiveness of the plaster which burned out the router bit in a matter of seconds — and because the abrasive wheel was not able to cut a uniform groove. The rotary cutter, however, was able to withstand the abrasive plaster with periodic replacement so that the cutting edges could be sharpened. The cutter wheel was adjustable in the saw housing for the purpose of cutting a groove of different widths and depths. This installation required a groove about ⅝ in. wide and deep which was the average depth of the plaster.

Plaster Dust Removed

The second problem — eliminating plaster dust from the air when grooving — was solved by employing an industrial type vacuum cleaner connected to the airtight housing of the rotary cutter by means of a flexible corrugated rubber hose. The vacuum cleaner thus sucked all but a negligible amount of dust into its receiver. Without the vacuum attachment, the saw could not have been used because the air became saturated with dust which would have prevented normal breathing and vision of the operator. The vacuum cleaner also prevented a heavy layer of plaster dust from settling in the rooms and corridors, thus reducing clean up time after the installation in each room had been completed.

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Grooving Obstacles

The third and last difficulty was one which had not been encountered previously. Soon after starting, the grooving operation ran into a snag. Unfortunately, the possibility of electrical conduit and other piping being buried in the plaster had not been anticipated. Thus, when the cutter ran into these obstacles the carbide teeth promptly snapped off, destroying the wheel. The cost of a new wheel made their continued replacement prohibitive. A hazard was also involved — that of electrocuting the operator by cutting "hot" conduit. Also, the cost of repairing the electrical wiring would have been prohibitive. Thus, the contractor faced the dilemma of finding a method for locating the buried "gremlins".

Detector Developed

A great deal of time was consumed in seeking advice and trying suggested methods, which ranged from the use of "divining rods" to "dip needles" and Geiger counters. Finally the problem was given to Thomas W. Phinney, an electronics engineer and within two weeks he had designed and built a miniature metal detector. It consists of a chassis containing radio tubes, electrical circuits, and batteries, into which plugs a set of earphones and a detector probe. To use the detector the operator puts the earphones on and passes the probe over the surface of the plaster wall along the paths where he intends to cut the groove. When the probe passes over a piece of buried conduit or pipe, an intense signal becomes audible in the earphones. The operator then marks the spot on the wall, so that he can later chisel a tunnel under the conduit or bypass it completely.

The detector is designed to detect only to a depth of about $\frac{3}{4}$ in. and therefore will not pick up piping or metal obstacles buried at greater depths. Metal lath does not affect the successful use of the detector. By altering the detector circuit slightly, the detector can be made to be effective at greater depths. The detector employs the principle of projecting a magnetic field which when interrupted, destroys the balance of the circuit which through an amplifier then produces the warning signal. The pipe fitter on the job is capable of operating the detector after a few minutes of instruction.

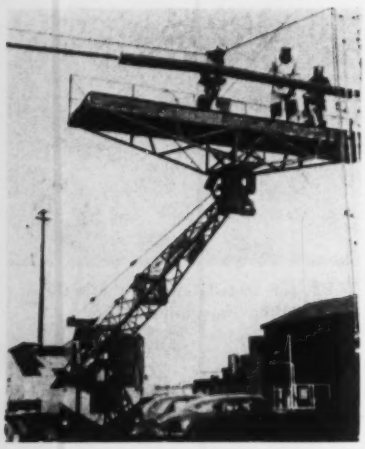
The entire unit weighs 5 lb, is contained in a chassis 6 in. x 5 in. x 4 in., and operates on inexpensive batteries. The cost of the detector equipment is nominal, considering the savings accomplished.

Having solved the third and final problem, the installation of this central oxygen system was able to proceed to a successful conclusion.

[Illustrations of power rotary cutter courtesy of Oxygen Equipment & Service Co.]

Applying Pipe Insulation Faster

Rotating stage at top of crane boom speeds work on overhead lines



THREE MEN insulated 92 ft of a 12 in. pipe line with $2\frac{1}{2}$ in. of insulation in one day

INSULATING HIGH overhead piping is no easy problem. Long pipe extending 30 to 60 ft in the air usually requires wood or steel scaffolding, special bracket supported staging and ladders. This is costly to erect, move, re-erect and dismantle. To simplify the application of this piping insulation a unique mobile crane staging has been developed.

A stage which will rotate 180 deg is mounted on top of the crane boom. The 4 ft x 20 ft wood floor of the stage is equipped with a high backrail and a low material scupper for catching tools and material that may fall.

Flexibility of movement is the crane's biggest advantage. Since piping is generally erected on a piecemeal basis, with sections left out of the line for valves and fittings that are due on the site later, segments of conventional scaffolding are often tied up waiting for these sections. However, the crane stage can be shifted easily for individual fitting insulation or tie-in work.

Although insulation coverage varies greatly with the number of fittings, specifications and size and length of pipe, three men recently insulated 92 ft of a 12 in. line with $2\frac{1}{2}$ in. of insulation in one day, using the crane stage. With conventional scaffolding, the same three men probably would not have exceeded 60 ft per day.

[Photo courtesy Armstrong Cork Co.]

Heating Contractor for Prudential Building

H. P. REGER & Co. is the heating contractor for the Prudential Insurance Co. of America building, now under construction on Chicago's lake front. The names of the other mechanical contractors were given in the October HPAC.

General Contractors See High Volume, Competition

ABUNDANT WORK but intensifying competition and steady pressure for higher wages lie ahead for the construction industry, it was reported at the mid-year meeting of the governing and advisory boards of the Associated General Contractors of America.

Materials and construction equipment are, and it is expected will continue to be, available and fairly well stabilized in price.

ENVIRONMENTAL STUDIES
THERMAL RESPONSE ON ENTERING AND LEAVING HOT ENVIRONMENTS
COOPERATIVE USE OF PHYSIOLOGIC AND ENGINEERING TECHNIQUES
DEMONSTRATION OF

Exhibit Shows Doctors How Easily People Adjust to A. C.

GREAT INTEREST in air conditioning was shown by the 17,500 doctors and their 21,000 guests at this year's annual meeting of the American Medical Association held in New York. The exhibit showing the ability of a person to respond to sudden changes in temperature and humidity was a big attraction. (This exhibit was also popular at the last International Heating, Ventilating and Air Conditioning Exposition held in Chicago in January, as was reported in HPAC for March 1953.)

The exhibit included two small air conditioned rooms, each with two transparent walls and a door. The conditions in one (76 F and 50 percent relative humidity) simulated those of an air conditioned space, and those in the other (100 F and 60 percent relative humidity) simulated those of a hot and humid street during the summer.

An attractive model — dressed in typical summer apparel and fitted with special temperature measuring thermocouples — after sitting in the comfort air conditioned environment for 10 minutes, passed rapidly into the hot-humid street environment. After remaining in the hot-humid environment for 10 minutes, she returned to the comfort air conditioned environment.

Temperature Changes Shown

Special instruments showed on charts the rapidity and magnitude of the changes in the body and skin temperatures as she passed from one environment to the other. Upon entering the hot room, it was shown how the skin temperature increased before sweating appeared, the time that was taken before sweating started, how constant the deep body or rectal temperature remained, and the resulting increase in blood flow to the skin.

When the girl returned to the comfortable air conditioned room, active sweating stopped immediately and the skin temperature dropped in a few minutes — being more marked on the feet and hands. A sense of cooling was noted until the perspiration trapped in the clothing had evaporated.

These adjustments were shown to be prompt, easy, and safe. This is not only true for healthy people, but also for most sick people who do not have a fever.

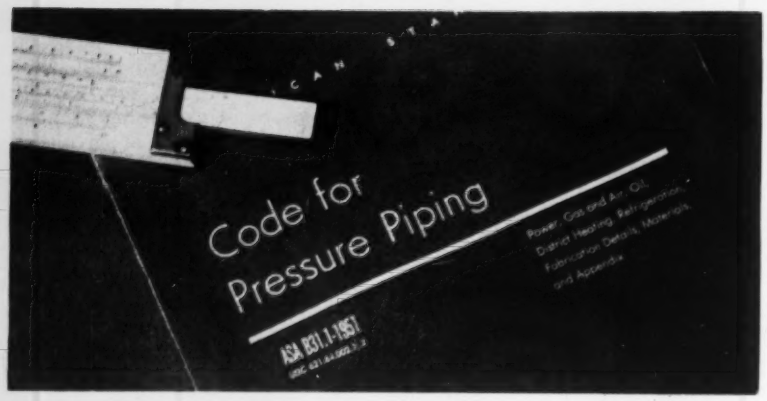
The exhibit included charts illustrating the nervous and vascular mechanisms of controlling heat loss — with certain cases of circulatory failure with fever and fainting due to extreme heat. An informative bulletin containing most of the charts displayed and entitled Regulation of Body Temperature in Comfortable and Hot Environments was made available to those attending.

The complete air conditioning systems for maintaining the preselected temperatures and humidities in the two spaces attracted a number of the medical doctors, and engineers from the University of Illinois, under whose direction it was built and operated, explained their operation. On hand to explain the exhibit were Dr. Robert W. Keeton, Dr. Ford K. Hick, Dr. Lionel Bernstein, and Tohru Inouye, all of the University of Illinois College of Medicine in Chicago, and Prof. M. K. Fahnestock of the College of Engineering at Urbana.

This exhibit was made possible by the support of the American Society of Heating and Ventilating Engineers, the U. S. Public Health Service, and the air conditioning industry.

Members of the ASHVE committee for revision of the code of minimum requirements for comfort air conditioning attended the exhibit, along with staff members of the ASHVE headquarters office in New York. Technical societies represented on this committee are the ASHVE, the American Society of Mechanical Engineers, the Air Conditioning and Refrigeration Institute, and the American Society of Refrigerating Engineers. Physicians from the AMA, U. S. Public Health Service, industry and educational institutions are also on the committee. Walter L. Fleisher, Sr., past-president of the ASHVE, is chairman.

The exhibit is now being modified to provide a permanent research facility at the University of Illinois. One of the first studies to be made with this new equipment is on the comparison of complete cotton outfits of clothing with complete nylon outfits from the standpoint of comfort. The studies will be conducted over a range of temperature and humidity conditions by the Home Economics Department and the Physical Environment Unit.



Code for Pressure Piping

"Task Force" Reports on Piping Flexibility

The reason for publishing this proposed text of the flexibility section of the Code for Pressure Piping is to acquaint the industry as a whole with the results of the work of the Task Force on Flexibility of ASA Committee B31.1 and to enlist the cooperation of the industry in formulating suitable clauses for inclusion in the Code for Pressure Piping. Comments by one of the leading piping manufacturers and engineers are printed in italics to distinguish them from the text agreed upon by the Task Force as a whole.

Specifically, it is desired that studies be carried out to establish to what extent the proposed rules conform to service experience in different piping fields, and whether the proposed stress range should be either liberalizd or made narrower. At the same time, it would be very helpful if readers would acquaint the committee with any test data which would serve to modify the flexibility and stress intensification factors which have been published here. Furthermore, any suggestions as to the wording of the text tending toward clearer definition of the type of systems which have to be analyzed and the responsibility of the different parties concerned in the design, fabrication and operation of piping systems will be appreciated in view of the fact that the Code has been made law in certain jurisdictions and may be expected to attain legal status in others.

The report of the Task Force has been accepted for publication and authorization has been given during this period of review to use either the proposed rules and alternative rules contained therein or the rules already published in the ASA B31.1 — 1951 Code.

Comments concerning the proposed new section on flexibility intended for consideration by the committee should be directed to L. W. Benoit, Secretary, ASA Sectional Committee B31, 420 Lexington Ave., New York 17.

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CHAPTER 3, Expansion and Flexibility, of Section 6 of the Code for Pressure Piping has been critically examined by a Task Force appointed by ASA Committee B31.1. The group engaged in this work has been guided by the results of research and practical experience gained since the conception of the present Code. The intention of this Committee has been to write regulations providing adequate safety without requiring extravagant use of materials, and at the same time to impose a minimum of restraint on procedure or method and avoid too stringent requirements regarding mathematical analysis.

The draft developed by the Task Force is presented here. A preliminary draft has been distributed to approximately 150 members of the industry and elicited considerable comment of a constructive nature. In presenting this preamble, the Committee intends to explain the reasons behind the proposed modifications to the current Code and invite more comments from the industry at large so as to conclude this work on the basis of the concerted opinion of all concerned.

PART I — INTRODUCTION AND DISCUSSION

One of the most significant changes is the introduction of the concept of stress range. The term has not been used in the current Code although the structure of the current formula for allowable stress implies a range of stress rather than a specific value. The designation "allowable combined stress" has obscured the intention and failed to imply that a piping system should be evaluated along lines different from those followed in the analyses of structures or machinery. The latter are designed to meet a limiting stress or distortion within the elastic limit of the material. A piping system can trespass beyond the elastic range with stress reversals from cold to hot condition provided the number of such reversals remains below certain limits so as to exclude the effect of fatigue. In contrast to structures, piping systems can absorb relatively large displacements without ill effect, changing from one shape to another without returning exactly to a previous configuration. A stress which cannot be sustained in the hot condition will drop to the level which the material *can* sustain. The drop in stress

will reappear as cold stress with opposite sign, thus springing the system without the application of extraneous work. The relaxation in the first heating cycles tends to establish a condition of permanency. The cold stress has lowered the upper limit of the hot stress, causing little or no further relaxation in succeeding cycles. The system eventually attains a state of equilibrium.

Because of this self-springing which occurs whenever the system is stressed above the level which can be sustained either in the cold or in the hot condition, any assignment of credit allowances for cold springing such as is provided in the current Code loses its significance *insofar as stresses are concerned*. On the other hand, in the case of reactions, cold springing remains significant since damage can be done to equipment in the initial cycle before the system has had time to adjust itself as a result of creep or yielding.

In line with the preceding, it is proposed that calculation of the *expansion stress* be based on the modulus of elasticity at room temperature for the following reasons:

1) In the case of temperatures in the creep range, the stress in the cold condition may be of greater magnitude than that in the hot condition, as the result of cold or self-spring.

2) In the case where lines operate at low temperatures, the difference between the hot modulus and the cold modulus is very small.

[However, when computing the reactions, the hot and cold moduli of elasticity are to be used, as shown in paragraph 621(d).]

It is evident that the true magnitude of the stresses in either the hot or the cold condition cannot be determined by calculation because the amount of relaxation is unknown and cannot be judged reliably. Stress intensities at any stage are therefore of academic interest only. The only statement that can be made with certainty is that a piping system is safe when the sum of the cold and the hot stresses does not exceed a stress range which is considered safe for the expected number of stress reversals.

The following allowable expansion stress range has been proposed on the basis of test data and the results of experience in practice:

$$S_A = f\,(1.25\,S_c + 0.5\,S_h) \quad \ldots [1]$$

S_A = Allowable expansion stress range, psi.

S_c = Allowable stress (S-value) in cold condition, psi.

S_h = Allowable stress (S-value) in hot condition, psi.

(For power piping operating below 650 F, $S_c = S_h$.)

For definitely cyclic conditions equation [1] is corrected by a stress reduction factor f, which is introduced to take care of the effects of fatigue. Formula [1] covers the expansion stresses only, a separate allowance of $\frac{3}{4}\,S_h$ having been set aside for stresses due to weight and longitudinal pressure. A comparison of the present Code formula with the new formula will be found in the Appendix.

The proposed version of the Code is believed to represent an improvement over the current Code in that it provides in paragraph 621(d) a rational approach to estimating the controlling reactions at anchorage or equipment connections.

The text as proposed represents the best thinking of the Committee on the subject. It is admittedly not perfect and it has been the subject of considerable discussion. Controversies have centered primarily around the three following subjects:

a) Under what circumstances should computations be compulsory? The Committee has carefully considered the various comments which have been received and is strongly of the opinion that it would be inadvisable to define when and under what conditions a stress analysis should be made. The cases involved are so numerous and so widely different that only the experienced, competent designer can cope with them. Also, the assignment of responsibility for the making of the necessary computations and seeing that the design requirements are followed is not subject to any formulation the Committee can think of, since there are so many different angles involved — such as contractual responsibility, design responsibility, inspection responsibility, etc.

b) The adequacy of the stress range as formulated has been questioned, there having been comments both that it was too low and that it was too high. Since there have been comments both on the plus and minus side, the Committee is of the opinion that the formula for the present should remain as proposed.

c) Paragraph 620(c) of the current Code stipulates that calculations shall take into account stress concentrations or intensification factors and permits credit for the extra flexibility where flexibility factors have been determined from test data, but gives no specific values. In the inter-

THE PIPING INDUSTRY in general is indebted to all members of the ASA B31 Task Force on Flexibility for contributing so generously of their time and effort in the development of this work. Particular mention is due H. C. E. Meyer and S. W. Spielvogel for the progress made by this group and to A. R. C. Markl for promoting the stress-range concept.

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est of uniform application of this rule it appears desirable to provide such data. Chart I gives stress intensification factors for the more common piping components as based on the best available information.

The above outlines the thinking of the majority of the Task Force, but it is recognized that there are other valid approaches to the subject. Therefore, alternate wording suggested by the M. W. Kellogg Co. for paragraphs 620 (a) through (i), 621 (c) and 622 (b) is presented in the proposed text of Chapter 3. Designers are encouraged to use both approaches and report to the Code Committee their experience and recommendation as to which is the better. In order to understand the issues involved, the following comments relative to the alternate paragraphs are given:

Comments on Alternate Paragraph 620 (a)

The issue between the two drafts of this paragraph hinges around the ability to state in the Code some practical combinations of service conditions to define the point beyond which calculations are mandatory and below which they are not mandatory. The draft in the text follows the very general wording that has existed in the Code for many years. The alternate wording presents the recommendations of a very large and responsible engineering firm, which has had a great deal of experience in both power plant and petroleum refinery piping. The representatives of this firm contend that such an indefinite rule largely makes Code requirements for piping flexibility meaningless, with calculations being made only by the conservative user, and avoided by others due to the expense involved. In appreciation that piping calculations involve significant engineering cost and are not essential for a large amount of average piping, the alternate provisions attempt to establish a reasonable base line beyond which piping flexibility calculations are to be mandatory. This base line consists of two approaches, the first of which is covered in alternate paragraph 620 (a) and the second in alternate paragraph 620 (c).

Comments on Alternate Paragraph 620 (c)

The second provision determining when flexibility calculations are to be mandatory is presented in this paragraph. Obviously, any rule as simple as that proposed cannot be expected to duplicate the result of the more extensive calculations, and depending on the proportions of the piping involved, will introduce a range of deviations from the more accurately determined values. Accordingly, the objective has been to establish a value which does not attempt to rigorously detect all piping systems where stresses may exceed the allowable, since to do so would involve a prohibitive number of unnecessary calculations. Instead, a middle position is taken so that under this paragraph calculations will be required, for the most part, only where over-

FLEXIBILITY FACTORS "k" AND STRESS INTENSIFICATION FACTORS "i"

TABLE OF FACTORS

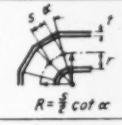
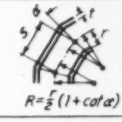
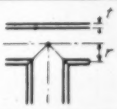
Description	Flexibility Factor "k"	Stress Intensification Factor "i"	Description	Flexibility Factor "k"	Stress Intensification Factor "i"	Characteristic "h"	Sketch
Butt Welded Joint, Reducer, or Welding Neck Flange	1	1.0	Welding Elbow, or Pipe Bend †	$\frac{1.65}{h}$	$\frac{0.9}{h^{\frac{2}{3}}}$	$\frac{tR}{r^2}$	
Double-Welded Slip-On or Socket Welding Flange	1	1.2	Mitre Bend † with close spacing: $s<r(1+\tan\alpha)$	$\frac{1.52}{h^{\frac{5}{6}}}$	$\frac{0.9}{h^{\frac{2}{3}}}$	$\frac{\cot\alpha}{2}\,\frac{ts}{r^2}$	
Fillet Welded Joint or Single-Welded Socket Welding Flange	1	1.3	Mitre Bend, with wide spacing: § $s\geq r(1+\tan\alpha)$	$\frac{1.52}{h^{\frac{5}{6}}}$	$\frac{0.9}{h^{\frac{2}{3}}}$	$\frac{1+\cot\alpha}{2}\,\frac{t}{r}$	
Lap Joint Flange (with ASA B16.9 lap joint stub)	1	1.6	Welding Tee per ASA B16.9	1	$\frac{0.9}{h^{\frac{2}{3}}}$	$4.4\,\frac{t}{r}$	
Screwed Pipe Joint or Screwed Flange	1	2.3	Reinforced Fabricated Tee (with pad or saddle)	1	$\frac{0.9}{h^{\frac{2}{3}}}$	$\frac{(t+\frac{1}{2}T)^{\frac{5}{2}}}{t^{\frac{3}{2}}r}$	Pad Saddle
Corrugated Pipe (straight or curved) or Creased Bend	5	2.5	Unreinforced Fabricated Tee	1	$\frac{0.9}{h^{\frac{2}{3}}}$	$\frac{t}{r}$	

CHART I — FLEXIBILITY FACTORS *k* and stress intensification factors *i*

*The flexibility factors k and stress intensification factors i in the table apply to fittings of the same nominal weight or schedule as the pipe used in the system, and shall in no case be taken less than unity. They apply over the effective arc length (shown by heavy dash-dot lines in the sketches) for curved and mitre elbows, and to the intersection point for tees.

†The values of k and i can be read directly from chart, entering with the characteristic h computed from the formulas given, where:

R = bend radius of welding elbow or pipe bend
r = mean radius of matching pipe
t = wall thickness of matching pipe
α = one-half angle between adjacent mitre axes
s = mitre spacing at center line
T = pad or saddle thickness

‡Where flanges are attached to one or both ends, the values of k and i in the table shall be corrected by the factors given below, which can be read directly from chart, entering with the computed h:

One end flanged: $h^{1/6}$ Both ends flanged: $h^{1/3}$

§Also includes single-mitre joint.

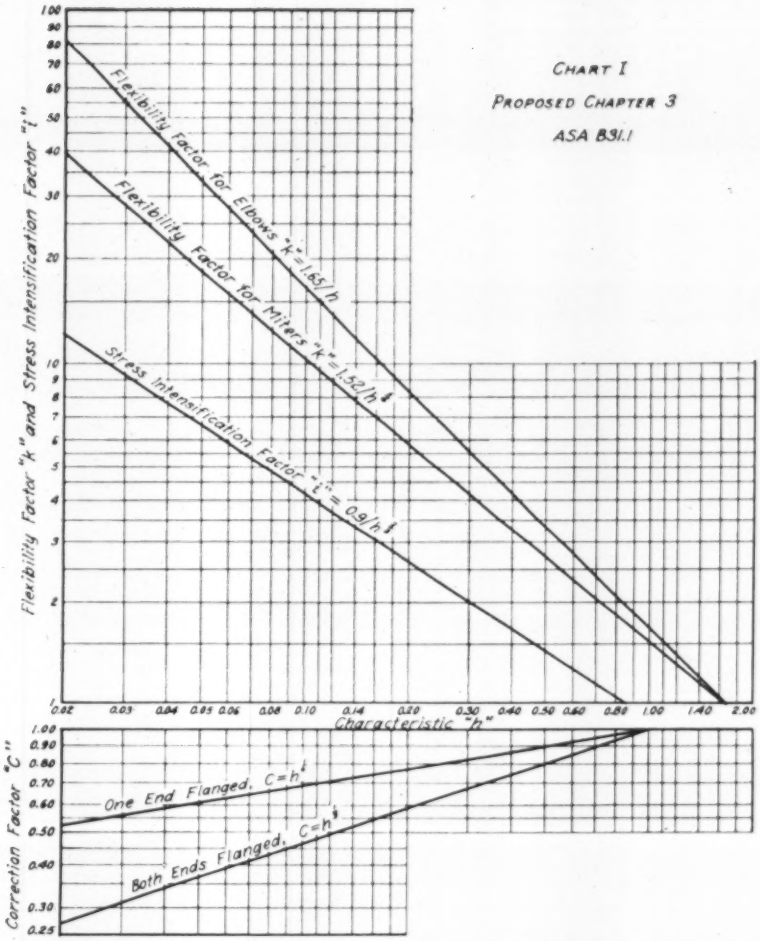


CHART I
PROPOSED CHAPTER 3
ASA B31.1
Flexibility Factor "k" and Stress Intensification Factor "i"
Flexibility Factor for Elbows "k" = 1.65/h
Flexibility Factor for Miters "k" = 1.52/h^⅔
Stress Intensification Factor "i" = 0.9/h^⅔
Characteristic "h"
Correction Factor "C"
One End Flanged, C = h^⅓
Both Ends Flanged, C = h^⅔

stress is probably present.

Comments on Alternate Paragraph 620 (*f*) and (*g*)

The draft, as written, brings into the calculations, for the first time, a set of stress intensification factors for numerous piping components which have not been in the Code heretofore. The use of these stress intensification factors is warranted, but there is a substantial element which feels that the use of these factors as they appear in the tables, will result in unnecessarily conservative design. The stress intensification factors themselves were derived from cyclic tests and the alternative paragraph therefore limits the mandatory application of these stress intensification factors to systems where more than 2000 *cycles are expected.*

Comments on Alternate Paragraph 621 (*c*)

The Committee draft establishes the stress range in Paragraph 621 (*c*) *in a combination with a limitation on the stress due to pressure and weight. The alternative paragraph eliminates the limitations of stress due to weight and pressure of* ¾ S_h *and arrives at essentially the same results by changing the formula for allowable* S_A *to:*

$$S_A = f\,(1.25\,S_c + 0.25\,S_h)$$

It is obvious that the two approaches give exactly the same results and the choice is essentially one of the method of procedure.

In the alternate wording of 621 (*c*), *the limitation contained in the first sentence is inserted for the purpose of making these rules applicable to cross country oil, gas and air piping, which in turn, would make possible the deletion of the limiting note which precedes Paragraph* 617.

PART II — TEXT OF PROPOSED RULES FOR CHAPTER 3 — EXPANSION AND FLEXIBILITY

[*NOTE*: The provisions of this chapter are not applicable to gas, air and oil cross country transmission (underground) piping.]

617 *Preamble.* (a) Piping systems are subject to a diversity of loadings creating stresses of different types and patterns, of which only the following more significant ones need generally be considered in piping stress analysis:

1) Pressure, internal or external.

2) Weight of pipe, fittings and valves, contained fluid, and insulation.

3) Thermal expansion of the line.

The first two loadings produce sustained stresses which are evaluated by conventional methods. The stresses due to thermal expansion, on the other hand, if of sufficient initial magnitude, will be relaxed as a result of local flow in the form of yielding or in the form of creep. The stress reduction which has taken place will appear as a stress of reversed sign in the cold condition. This phenomenon is designated as self-springing of the line and is similar in effect to cold springing. The amount of such self-springing will depend on the magnitude of the initial hot stress and the temperature. Accordingly, while the hot stress tends to diminish with time, the sum of the hot and cold stresses during any one cycle will remain substantially constant. This sum is referred to as the stress range. The fact that the stress range is the determining factor leads to the selection of an allowable combined stress (range) in terms of the sum of the hot and cold *S*-values.

(b) The beneficial effect of judicious cold springing in assisting the system to attain its most favorable condition sooner is recognized. Inasmuch as the life of a system under cyclic condition depends primarily on the stress range rather than the stress level at any one time, no credit for cold spring is warranted with regard to stresses. In calculating end thrusts and moments acting on equipment containing moving or removable parts with close clearances, the actual reactions at any one time — rather than their range — are significant and credit accordingly is allowed for cold spring in the calculations of thrusts and moments.

618 *Materials.* (a) This chapter applies to all classes of materials permitted by the Code.

(b) The thermal expansion range *e* shall be determined from Table ——* as the difference between the unit expansion shown for the maximum normal operating metal tem-

perature and that for the minimum normal operating metal temperature (for hot lines, this may usually be taken as the erection temperature). For materials not included in this table, reference shall be made to authoritative source data, such as publications of the National Bureau of Standards.

(c) The cold and hot moduli of elasticity, E_c and E_h, respectively shall be taken from Table —* as the values shown for the minimum and maximum normal operating metal temperatures, respectively. For materials not included in this table, reference shall be made to authoritative source data, such as publications of the National Bureau of Standards.

(d) Poisson's ratio may be taken as 0.3 for all ferrous materials at all temperatures. (Elsewhere in the Code there will be found tables of values of Poisson's ratio for various materials, which tables are given for general information.)

(e) The S values, S_c and S_h, at the minimum and maximum operating metal temperatures, respectively, to be used for determining the allowable expansion stress range S_A shall be taken for the type of piping system involved from the applicable tables in the respective sections of the Code. In the case of welded pipe, the longitudinal joint efficiency may be disregarded.

619 *General.* (a) Piping systems shall be designed to have sufficient flexibility to prevent thermal expansion from causing (1) failure from over-stress of the piping material or anchors, (2) leakage at joints or (3) detrimental distortion of connected equipment resulting from excessive thrusts and moments.

(b) Flexibility shall be provided by changes of direction in the piping through the use of bends, loops and offsets; or provision shall be made to absorb thermal strains by expansion joints of the slip joint or bellows types.** If desirable, flexibility may be provided by creasing or corrugating portions or all of the pipe.

(c) In order to modify the effect of expansion and contraction, runs of pipe may be cold sprung. Cold spring may be taken into account in the calculation of the reactions as shown in paragraph 621 (d) provided an effective method of obtaining the designed cold spring is specified and used.

620 *Basic Assumptions and Requirements.* (a) Formal calculations or model tests shall be required only where reasonable doubt exists as to the adequate flexibility of a system. Each problem shall be analyzed by a method appropriate to the conditions.

(b) Standard assumptions and requirements are given in paragraphs (d) to (g). Where simplifying assumptions are used in calculations or model tests, the likelihood of attendant under-estimates of forces, moments and stresses shall be taken into account.

(c) In calculating the flexibility of a piping system between anchor points, the system shall be treated as a whole. The significance of all parts of the line and of all restraints, such as solid hangers or guides, shall be considered.

(d) Calculations shall take into account stress intensification factors found to exist in components other than plain straight pipe. Credit may be taken for the extra flexibility of such components. In the absence of more directly applicable data, the flexibility factors and stress intensification factors shown on Chart I may be used.

(e) Dimensional properties of pipe and fittings, as used in flexibility calculations, shall be based on nominal dimensions.

(f) The total expansion range from the minimum to the maximum normal operating temperature shall be used in all calculations, whether piping is cold sprung or not. Not only the expansion of the line itself but also linear and angular movements of the equipment to which it is attached shall be considered.

(g) Flexibility calculations shall be based on the modulus of elasticity E_c at room temperature.

Alternate Paragraph 620, as proposed by the M. W. Kellogg Co.

620 *Basic Assumptions and Requirements.* *(a) Formal analysis or model tests shall be required for pipe lines which simultaneously satisfy the following conditions:*

Maximum normal operating metal temperature over 800 F.

Nominal pipe diameter over 6 in.

Rated service pressure over 15 psi.

The method of investigation shall be appropriately selected to conform with the condition of the problem under examination.

(b) The requirements for analysis shall be considered satisfied for duplicate units of successfully operating installations or for replacements of piping systems with a record of satisfactory service.

(c) It is recognized that for operating conditions not satisfying concurrently the provisions of paragraph (a), an analysis for each piping system is economically impractical. An analysis is, therefore, mandatory only if the following approximate criterion is not satisfied:

$$[DY]/[U^2(R-1.05)^{3/2}] \leqq 0.03$$

(The constants 1.05 and 0.03, as well as the exponent of 3/2, represent only approximate values, which will be subject to further investigation and correction as needed.)

D = Nominal pipe size, in.

Y = Resultant of restrained thermal expansion and net linear terminal displacements, in.

U = Anchor distance (length of straight line joining anchors), ft.

R = Ratio of developed pipe length to anchor distance, dimensionless.

(d) Standard assumptions and requirements are given in paragraphs (f) to (i).

(e) In calculating the flexibility of a piping system between anchor points, the system shall be treated as a whole. The significance of all parts of the line and of all restraints, such as solid hangers or guides, shall be considered.

(f) For calculations made in conformity with paragraph (a), stress intensification and flexibility factors may be omitted if the piping system is not subject to more than 2000 stress cycles during its expected life. For lines subject to more than 2000 stress cycles, calculations shall take into account stress intensification factors found to exist in components other than plain straight pipe. Credit may be taken for the extra flexibility of such components. In the absence of more directly applicable data, the flexibility factors and stress intensification factors shown on Chart I may be used.

(g) For thermal expansion analysis, dimensional properties of pipe and fittings shall be based on nominal dimensions.

*Tables of these properties will be provided upon adoption of these rules. In the meantime, data published in piping handbooks or catalogs may be used.

**In this case anchors or ties of sufficient strength and rigidity shall be installed to provide for end forces due to fluid pressure and other causes.

(h) The total expansion range from the minimum to the maximum normal operating temperature shall be used in all calculations, whether piping is cold sprung or not. Not only the expansion of the line itself but also linear and angular movements of the equipment to which it is attached shall be considered.

(i) Flexibility calculations shall be based on the modulus of elasticity E_c at room temperature.

621 *Stresses and Reactions.* (a) Using the above assumptions, the stresses and reactions due to expansion shall be investigated at all significant points.

(b) The expansion stresses shall be combined in accordance with the following formula:

$$S_E = (S_b^2 + 4\,S_t^2)^{1/2}$$

$S_b = i\,M_b/Z$ = Resultant bending stress, psi.
$S_t = M_t/2Z$ = Torsional stress, psi
M_b = Resultant bending moment, lb-in.
M_t = Torsional moment, lb-in.
Z = Section modulus of pipe, in.^{3}
i = Stress Intensification Factor

(c) The maximum computed expansion stress S_E shall not exceed the allowable stress S_A where:

$$S_A = f\,(1.25\,S_c + 0.5\,S_h)$$

subject to the limitations of paragraph 622 (b)

f = Stress range reduction factor for cyclic conditions to be applied. In the absence of more applicable data the values of f shall be taken from table below:
S_c = Allowable stress (*S*-value) in the cold condition.
S_h = Allowable stress (*S*-value) in the hot condition.

S_c and S_h are to be taken from the tables in the applicable sections of the Code.

Total number of full temperature cycles over expected life	Stress reduction factor f
7,000 and less	1.0
14,000	0.9
22,000	0.8
45,000	0.7
100,000	0.6
250,000 and over	0.5

(d) The reactions (forces and moments) R_h and R_c in the hot and cold conditions, respectively, shall be obtained as follows from the reactions R derived from the flexibility calculations:

$R_h = [1 - (2/3C)] \times (E_h/E_c) \times R$
$R_c = C\,R$ or
$R_c = [1 - (S_h/S_E)(E_c/E_h)] \times R$
whichever is greater, and with the further condition that
$(S_h/S_E) \times (E_c/E_h)$ is less than one
C = Cold spring factor varying from zero for no cold spring to one for 100 percent cold spring.
S_E = Maximum computed expansion stress.
E_c = Modulus of elasticity in the cold condition.
E_h = Modulus of elasticity in the hot condition.
R = Range of reactions corresponding to the full expansion range based on E_c.
R_c and R_h represent the maximum reactions estimated to occur in the cold and hot conditions, respectively.

(e) The reactions so computed shall not exceed limits which the attached equipment can safely sustain.

Alternate Paragraph 621 (c), as proposed by the M. W. Kellogg Co.

(c) The maximum combined pressure and expansion stress shall not exceed 0.75 times the rated ultimate tensile strength of the annealed material at room temperature. The maximum computed expansion stress S_E shall not exceed the following allowable value:

$$S_A = f(1.25\,S_c + 0.25\,S_h)$$

f = Stress reduction factor to be applied for cyclic service. In the absence of more applicable data the values of f shall be taken from the table below.
S_c = Allowable stress (*S*-value) in the cold condition.
S_h = Allowable stress (*S*-value) in the hot condition.
S_c and S_h are to be taken from the tables in the applicable sections of the Code.

If the sum of longitudinal pressure and weight stresses is less than S_h, the difference between S_h and the sum of these stresses may be added to S_A.

Total number of full temperature cycles over expected life	Stress reduction factor f
7,000 and less	1.0
14,000	0.9
22,000	0.8
45,000	0.7
100,000	0.6
250,000 and over	0.5

622 *Supports.* (a) Pipe supports and restraints not expressly considered in flexibility calculations shall be designed to minimize interference with the thermal expansion of the line.

(b) The design and spacing of supports shall be checked to assure that the sum of the longitudinal stress due to weight and pressure does not exceed S_h. Where this sum exceeds $\frac{3}{4}\,S_h$ but does not exceed S_h, the amount in excess of $\frac{3}{4}\,S_h$ shall be subtracted from S_A.

Alternate Paragraph 622 (b) as proposed by the M. W. Kellogg Co.

(b) The design and spacing of supports shall be checked to assure that the sum of the longitudinal stress due to weight and pressure does not exceed S_h. The analysis for pressure stresses shall be based on the eroded dimensions of the pipe.

PART III — APPENDIX — COMPARISON OF ALLOWABLE EXPANSION STRESSES IN CURRENT AND PROPOSED CODE.

(a) Expansion Stress

The allowable range of expansion stresses under the proposed rules is given as follows:

$$S_A = 1.25\,S_c + 0.5\,S_h \quad \ldots\ldots [1]$$

S_A is the allowable expansion stress to be compared with the maximum calculated expansion stress, based on the room temperature modulus of elasticity E_c. S_c is the *S*-value in the cold condition. S_h is the *S*-value at operating temperature.

Formula [1] covers the expansion stresses *only*, an allowance of $\frac{3}{4}\,S_h$ having been set aside for stresses due to weight and longitudinal pressure. There is no further allowance for cold springing.

The current Code formula, which covers *both* expansion and longitudinal pressure stresses, can be rewritten to parallel the above expression by subtracting the longitudinal pressure stress S_p, as follows:

$$S_A = 3/4\,(S_c + S_h) - S_p \quad \ldots\ldots [2]$$

In distinction from the proposed rules, the current Code allows one-third credit for cold springing, which in effect raises the permissible expansion stress 50 percent. The weight stress is not specifically included.

With one-third credit for cold spring and the notations below, the current Code formula is interpreted as follows:

$$2/3\,S_{Eh} \leq 3/4\,(S_c + S_h) - S_p$$

S_{Eh} is the calculated expansion stress based on the modulus of elasticity E_h at operating temperature.

Substituting $S_p = \frac{1}{2}\,S_h$, which is the maximum the longitudinal pressure stress can attain since it equals one-half the hoop stress which is limited to S_h:

$$2/3\,S_{Eh} \leq 3/4 S_c + 1/4\,S_h \quad \ldots [3a]$$

and, with $S_p = 0$, which is the minimum:

$$2/3\,S_{Eh} \leq 3/4\,S_c + 3/4\,S_h \quad \ldots [4a]$$

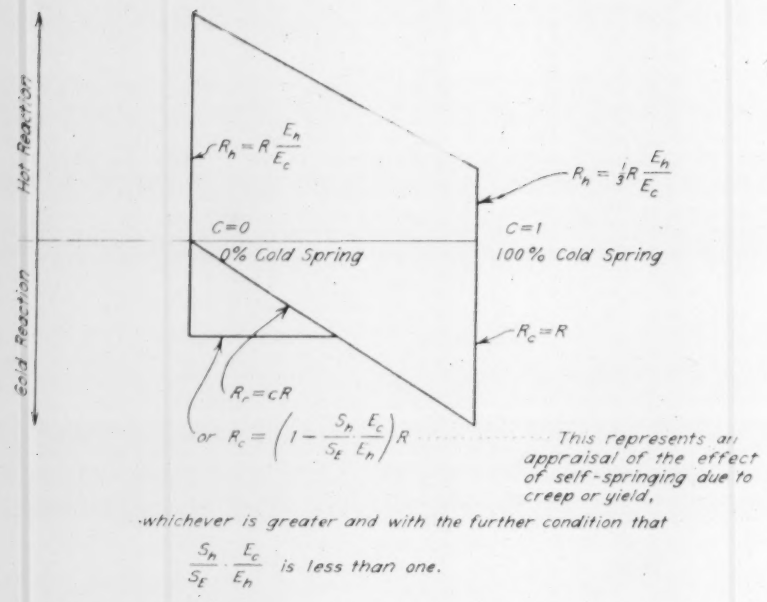
To transform the expansion stress S_{Eh} based on the hot modulus E_h to the stress S_E based on the cold modulus E_c, we must substitute $S_E = (E_c/E_h)\,S_{Eh}$, which gives:

$S_E = (E_c/E_h)\ (9/8\,S_c + 3/8\,S_h)$ for $S_p = 1/2\,S_h$ $\ldots\ldots [3b]$

and

$S_E = (E_c/E_h)\ (9/8\,S_c + 9/8\,S_h)$ for $S_p = 0$ $\ldots\ldots [4b]$

Since E_c/E_h at most is 1.5 for


Hot Reaction
Cold Reaction
$R_h = R\frac{E_h}{E_c}$
$P_h = \frac{1}{3}R\frac{E_h}{E_c}$
C=0
0% Cold Spring
C=1
100% Cold Spring
$R_c = R$
$R_r = cR$
or $R_c = \left(1 - \frac{S_h}{S_E}\frac{E_c}{E_h}\right)R$
This represents an appraisal of the effect of self-springing due to creep or yield,
whichever is greater and with the further condition that
$\frac{S_h}{S_E}\cdot\frac{E_c}{E_h}$ is less than one.

FORMULAS PERMIT estimating the reactions in the cold condition due to self-springing as expressed by the formula for R_c

usual hot piping and unity for cold piping, we obtain as a limit for hot piping:

By current formula ($S_p = 1/2\ S_b$):

$$S_E = 1.69\ S_c + 0.56\ S_b \quad \text{....[3c]}$$

By current formula ($S_p = 0$):

$$S_E = 1.69\ S_c + 1.69\ S_b \quad \text{.....[4c]}$$

By proposed formula (any S_p):

$$S_E = 1.25\ S_c + 0.50\ S_b \quad \text{.....[1]}$$

and as a limit for cold piping, i.e., piping operating below 650 F (with $S_h = S_c$):

By current formula ($S_p = 1/2\ S_b$):

$$S_E = 1.5\ S_c \quad \text{.....[3d]}$$

By current formula ($S_p = 0$):

$$S_E = 2.25\ S_c \quad \text{.....[4d]}$$

By proposed formula (any S_p):

$$S_E = 1.75\ S_c \quad \text{.....[1a]}$$

It is evident from the above that the proposed rules in general give more conservative results for piping which has been cold sprung 50 to 67 percent by comparison with the current rules, which allow cold spring credit.

On the other hand, for conditions where the system is installed stress free or, as the other extreme, with 100 percent cold spring, except when $S_p = 0$, the proposed rules will be found to be considerably more liberal than those currently in use.

(b) *Combining the expansion stresses*

The formula of paragraph 621 (b) represents twice the shearing stress resulting from the tri-axial stresses which act on an element of the pipe wall. This stress is compared with the permissible tensile stress in accordance with Coulombs "maximum shear theory", which states that: "Failure will not occur when double the shearing stress is less than the allowable stress in straight tension."

Let S_t denote the shear stress, S_b the bending stress, S_{pl} the longitudinal pressure stress, and S_{pc} the circumferential pressure stress:

$S_l = S_b + S_{pl}$ the total longitudinal stress

With the above notation, twice the shear stress equals

$$[4\ S_t^2 + (S_l - S_{pc})^2]^{1/2} \quad \text{.....[a]}$$

Substituting for $S_{pc} = 2\ S_{pl}$ and for $S_l = S_b + S_{pl}$, Equation [a] becomes:

$$[4\ S_t^2 + (S_b + S_{pl} - 2\ S_{pl})^2]^{\frac{1}{2}} \quad \text{.....[b]}$$

The pressure stresses are now removed from this formula because the formula for the stress range excludes the pressure stresses. Thus, we obtain:

$$[4\ S_t^2 + S_b^2]^{1/2} \leq 1.25\ S_c + S_h = S_A$$

(c) *Reactions*

In contrast to the procedure proposed for determining the stresses, the method for recording the magnitude of the reactions is based on the initial condition with no consideration for subsequent relaxation. The formulas of paragraph 621(d) also take into account the effect of cold springing.

Thus, the manufacturer of equipment is protected against excessive actions during the initial stages of operation and the user is granted adequate benefit for cold springing the systems.

The formulas for the reactions also permit estimating the reactions in the cold condition due to self-springing, as expressed by the formula for R_c in the accompanying diagram.

Attention is called also to the intensity of R_h for 100 percent cold springing.

Reclaim Asbestos for Piping Insulation

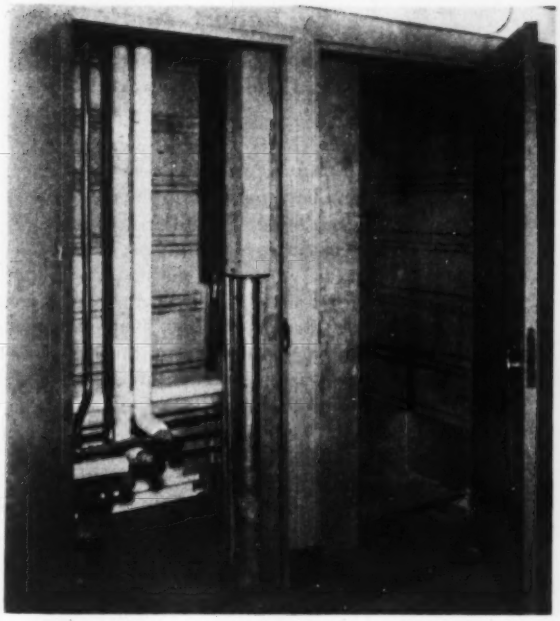
SIMPLE PROCEDURES for reclaiming asbestos from discarded pipe insulation have been developed by E. W. Zimmerman of the National Bureau of Standards. Extraneous material is removed from the asbestos cloth by chemical treatment, and the cleaned cloth is reduced to fiber form in a paper-pulp beater. The recovered asbestos is unchanged chemically, with little or no shortening of the fibers. It appears well suited to further use as electrical and heat insulation, for making asbestos paper, and as a filler in molded plastic compounds, according to the NBS.

As large quantities of molded asbestos and asbestos cloth are used to insulate pipes of various kinds in naval vessels, the Navy Bureau of Ships requested the NBS to study the possibilities of reclaiming asbestos insulation discarded during the repair or refitting of ships.

Aluminum Alloys Listed in Pressure Vessel Code

ANOTHER SIGN OF "stiffening competition between metals" is the listing for the first time of five additional aluminum alloys in the latest ASME boiler and pressure vessel code, according to J. K. Wareham, chief engineer of the jobbing division of the Aluminum Co. of America. Seven aluminum sheet and plate alloys are now listed and, also for the first time, alloy specifications have been included for bolting materials, pipe, tube and forgings; and bars, rods and shapes.

The sheet and plate alloys now listed, 4S, 50S, 52S, 61S, and a new high purity, highly corrosion resistant alloy, represent a considerable increase in strength over previously listed 2S and 3S alloys. Fabrication techniques also have been developed for these alloys, pointing the way to more technological developments.



VERTICAL PIPING installed in utility shafts is easily accessible for maintenance and changes

INDIVIDUAL TWO SPEED exhaust fans provide ventilation control for each hood

New Air Conditioned Lab Has Well-Planned Piping, Ventilation

A NEW three-story research building of the Continental Oil Co. at Ponca City, Okla., is not only completely air conditioned for the comfort of the workers but also provides special temperature and humidity control in several of the laboratories. For example, the relative humidity is controlled at 40 percent and the temperature at 70 F in one laboratory. The calculated cooling load for the 40,000 sq ft building, under design conditions, is approximately 500 tons. The building is insulated and equipped with double pane windows.

The piping system is also well planned. All utilities — including hot, cold and de-ionized water, compressed air, utility vacuum, steam at 15 psi, and natural gas — are distributed in vertical shafts from the equipment room in the sub-basement to the roof penthouse. Every 22 ft on each side of the central halls, a vertical shaft passes down from the penthouse to three laboratory floors below. These shafts also carry the hood exhaust ducts and electrical conduits. On each floor, hollow metal doors give access to the utility shafts, making repair and change of duty rapid and economical.

In addition to the utilities supplied from the sub-basement, the laboratories are equipped with two gas lines from compressed gas cylinders located in the utility supply shafts. Thus, the needs of any laboratory for oxygen, helium, chlorine or other gases can be supplied by simply installing the correct control system and the proper cylinders of gas.

The ventilation system is equally well planned. All chemical and gas hoods are adjacent to the utility shafts and individual ducts from each exhaust hood pass vertically to individual two speed exhaust fans in the penthouse. This system insures sufficient air volume for each hood that can be controlled, which minimizes the possibility of noxious or poisonous gases flowing from one hood to another. The exhaust hoods have the same depth as the utility shafts. Thus, the ducts connecting them with the fans are extended directly up through the shafts to the fans.

The new laboratory was designed and constructed by the Wigton-Abbott Corp., Plainfield, N. J.

1 CONTINUOUS SLOT at bottom of ducts delivers warm air downward to blanket windows and walls. Note how ducts bypass electrical and plumbing lines. Also note evenly spaced braces along slot, and ducts designed to insure uniform discharge velocities of 1000 fpm

Unique Perimeter Slot Heats Plant

By Robert A. Hoehne
Application Engineer
L. J. Mueller Furnace Co.

A UNIQUE PERIMETER heating system has been installed in the new Quality Press building in Milwaukee. The system employs continuous slots ½ in. wide which are located above the windows. Uniform delivery of warm air through the slots is accomplished by supplying the air through properly sized continuous ducts extending toward both ends of the building.

Hard To Heat

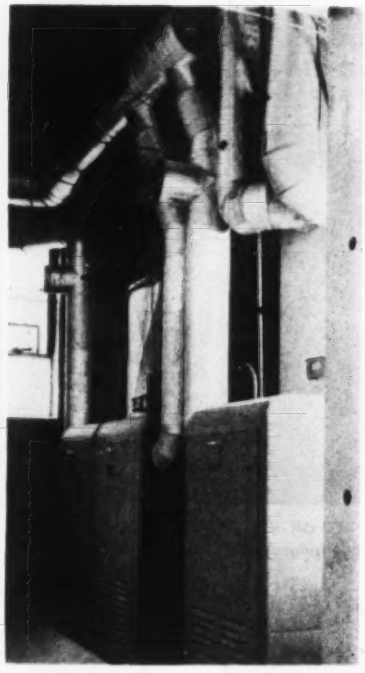
Concrete block walls and a concrete floor slab make the building a hard one to heat. Also, there are large window areas for good lighting. In addition to these construction features, the printing processes require close control of room air temperature and humidity. Realizing all the problems, the owners insisted that the heating system provide the desired indoor environment and be flexible and easy to balance. Of course, cost of the installation was also an important factor.

Three Furnaces Used

Three oil fired forced warm air furnaces, each with a bonnet output of 120,000 Btu per hr, are used. One takes care of the office area, and the others supply the perimeter slot system in the shop. The two furnaces for the shop provide two separate zones, one for the south and one for the north side of the building. With the large expanse of glass facing the south, it was necessary to use two separate furnaces or a zone control system. The decision to use the two separate furnaces was made because it was felt that the desired results could be obtained at lower cost.

Uniform Velocities

The long supply ducts are above the windows for two reasons. First, the owners specified that the ducts be overhead since floor space is at a premium. Second, by applying the principles of perimeter heating to these conditions, it was determined that the supply ducts should extend along the exterior walls. In this way the warm air could blanket the areas having the greatest heat loss. However, the use of continuous slots to deliver air downward over the win-



2 THREE FURNACES provide separate zones for heating. The unit at the right supplies the heating for the offices, and the two units to the left supply the perimeter slot ducts for the shop

dows is a unique solution in the field of perimeter heating.

The installation was designed to provide an air velocity along the slot of 1000 fpm by reducing the duct size as the end was approached. Special deflectors were installed in the ducts which aided in diverting the air out of the slots uniformly. Observations by a direct reading air velocity meter confirmed this uniform velocity showing that variations of only 50 fpm are experienced.

Simple Return

By forcing the warm air downward across the windows and thereby nullifying the areas of largest heat loss, it was not necessary to install a complicated return system. There is only one 24 in. x 48 in. return air intake close to the furnace room for the entire shop area.

The heating system was designed by A. Hoffman, Louis Hoffman Co., and installed by the G. F. Marth Co., heating contractors, both of Milwaukee. According to Mr. Marth, the simplified duct system with the continuous slot permitted a fast and low cost installation.

Piping Code Committee Rules on Flexibility

FROM TIME TO TIME certain actions of the Sectional Committee B31 on the American Standards Association Code for Pressure Piping, sponsored by The American Society of Mechanical Engineers, are issued for the information of interested parties. While these do not constitute formal revision of the Code, they may be utilized in specifications, or otherwise, as representing the considered opinion of the Committee.

Pending revision of the Code for Pressure Piping, ASA B31.1-1951, the Sectional Committee has recommended that selected interpretations be published so that industry may take immediate advantage of corresponding proposed revisions.

The following information is published by special permission of The American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Cases 10, 11 and 12 apeared in the September 1952 HPAC. Case 5 was annulled and Case 7 corrected in the April 1952 HPAC. Cases 6, 7, 8 and 9 appeared in the October 1951 HPAC, and Case 5 in the August 1951 HPAC. Cases 1 to 4, issued prior to the latest revision of the Code, have been annulled. Case No. 13 is published herewith as interim actions of Sectional Committee B31 on the Code for Pressure Piping that will not constitute a part of the Code until formal action has been taken by the ASME and by the American Standards Association on a revision of the Code.

Case No. 13

Inquiry: What is the status of the "Report of Task Force on Flexibility, May 4, 1953" and Par. 620 in the 1951 Edition of the Code?

Reply: It is the opinion of the Committee that until a new edition of the Code is published revising Par. 620, any of the following procedures will meet the intent of the Code as it applies to piping flexibility.

(a) Follow the present wording of the Code, Par. 620.

(b) Follow the proposed revised wording given in the "Report of Task Force on Flexibility, May 4, 1953".

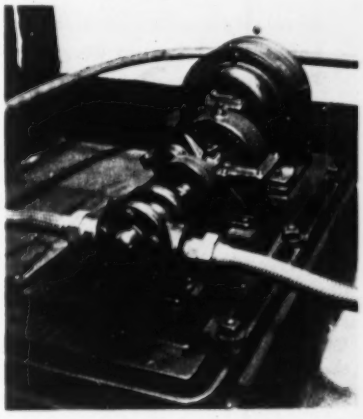
(c) Follow the proposed wording in the above Task Force Report, except using the alternate paragraphs contained in the report.

Metal Hose Licks a Pump Problem

FLEXIBLE METAL HOSE has solved a pump maintenance problem at the Wheatena Corp., Rahway, N. J.

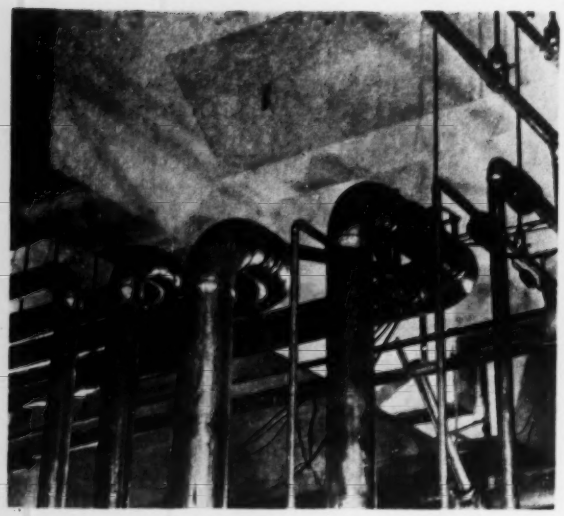
To give "Wheatena" its individual flavor, and to shorten cooking time in the kitchen, the grain is roasted in large pans in two roast rooms. The pans are oil fired, and the fuel oil is pumped from ground level to the fourth floor where the grain is roasted. One oil pump serves each of the two roast rooms.

In the photo of one of the two pumps, the metal hose on the left is the suction line to the pump and the other hose is the discharge line. The pump is driven by a motor solidly fitted to a machined base. At first the suction and discharge lines on the pump were solid pipe, and to make them tight it was necessary to draw up the fittings very snug. This tended to throw the pump out of alignment and put a considerable strain on the pump bearings. The strain was so bad that it was necessary to repack the bearings on each of the two pumps twice each year.

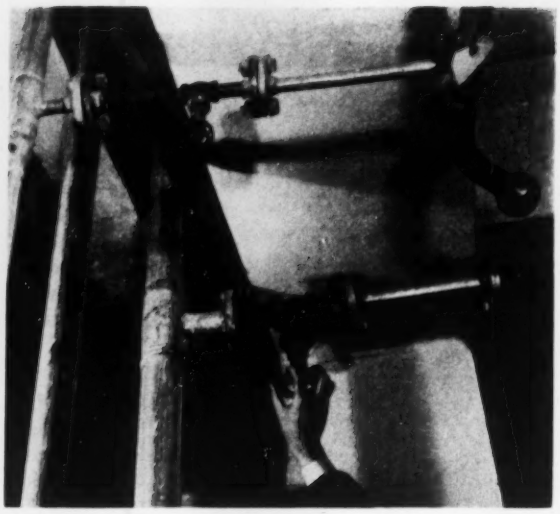


ONE OF THE two fuel oil pumps at the Wheatena plant showing metal base hose used for the suction and discharge lines. Strain on pump bearings is eliminated by the flexibility of the hose.

According to W. J. Heim, maintenance superintendent at the plant, the pump bearings have not been repacked since the metal hose has been used. [Photo courtesy Titeflex, Inc.]



THIS PIPING at the Alcoa building is clad 3S aluminum, which is used for many services



FLANGED PROTECTOR SECTIONS are used between the aluminum and copper piping

Aluminum Piping's Applications

. . . are illustrated by the installations at the new Alcoa building in Pittsburgh. Many possibilities seen in industrial and big buildings

By E. T. Wanderer
Head, Hydraulics Section
Sales Development Div.
Aluminum Co. of America

ALUMINUM PIPE and tube have been manufactured for many years, but only recently has the versatility of these materials become widely recognized. Two important factors have contributed to this situation. First, the price of many tubular products of aluminum alloys is competitive with other materials and in some cases is lower in cost. Second, the tremendous expansion of the aluminum industry and the almost limitless source of raw materials for producing aluminum have made it evident that for the long pull, aluminum will be in plentiful supply.

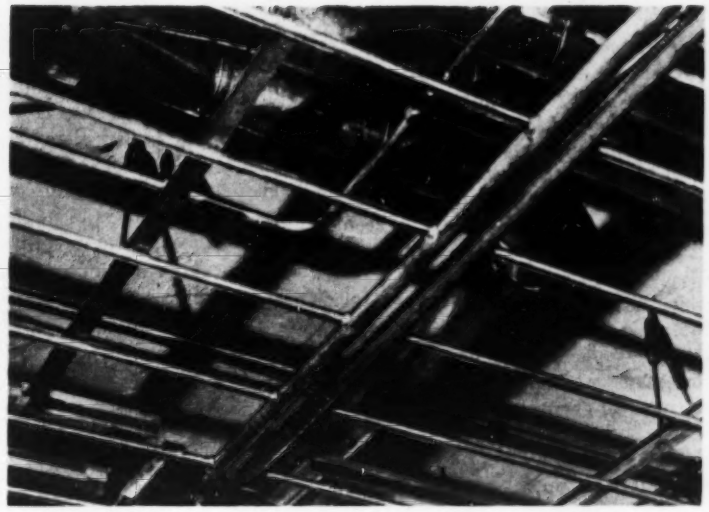
Alcoa's Skyscraper

When the Aluminum Co. of America began to plan its new 30 story Pittsburgh office building, a detailed study was made of various applications where tubular products were required. This study included a cost survey as well as a decision on the suitability of aluminum for the particular application based on actual previous experience, laboratory data or considered opinion. It was recognized that it would be necessary to pay more for certain components (valves, special fittings, etc.) in aluminum than in conventional materials. But it was felt that such prices could, in the future, be reduced as a result of volume production. As a result, aluminum tubular products were widely employed in the new building.

Water Supply Piping

Back of the decision to use aluminum for water supply piping was over 20 years' experience with aluminum hot and cold water supply systems at Alcoa's Aluminum Research Laboratories, at New Kensington, Pa. Original piping at the laboratories was of 2S and 3S alloys, and alterations and extensions to the systems were made with a clad 3S material.* There has been no replacement of the clad 3S pipe, some of which has been in service for 20 years. This product [see Dix, Jr., E. H., National Advisory Committee for Aeronautics, Technical Note 259, August, 1927; Dix, Jr., E. H., U. S. Patent 1,865,089, June 28, 1932; Brown, R. H., U. S. Patent 1,997,165, June 9, 1935] is 3S alloy with an interior cladding of 72S alloy comprising 10 percent of the total wall thickness. Alloy 72S,

*The cladding referred to throughout this article is specifically selected to provide cathodic protection of the 3S core.



ALUMINUM CEILING GRIDS are used for heating and cooling the building. Photo also shows aluminum duct work

THE ALCOA BUILDING illustrates many applications of aluminum

containing 1 percent zinc, electrochemically protects the 3S alloy core and as a result, the clad 3S and similar clad products are highly resistant to perforation in many environments that promote pitting. In view of the similarity between New Kensington and Pittsburgh tap waters, aluminum was considered suitable for the hot and cold water supply and drinking water systems. From an economic standpoint, the cost of the aluminum pipe per foot was estimated to be less than half of the cost of the pipe which would normally have been used. Moreover, use of aluminum pipe saved a considerable quantity of other materials which were in short supply during the construction of the building.

Protector Sections

Even though Pittsburgh tap water was considered compatible with the clad 3S material, the existence of corrosion hazards to the aluminum pipe as a result of possible contact with dissimilar metals — particularly copper and copper alloys — was recognized. It was felt impractical to attempt to isolate the aluminum electrically from dissimilar metals, since insulated joints between the two metals would likely be rendered ineffective because of short circuits through the building structure or by other means. Therefore a "protector section" was devised. This consists of a short length of Schedule 80, clad 3S pipe which is designed to bear the brunt of any electrolytic attack that occurs and is, therefore, replaceable. It was not felt practical to attempt to eliminate copper and copper alloys from the valves and fittings on the various fixtures on each floor, and it also did not seem practical to install a "protector section" at each such valve. It was decided, therefore, to limit the use of aluminum to the risers; this automatically reduced the number of required "protector sections" to the number of riser branch outlets on each floor.

Use of copper and copper alloys was avoided where possible in favor of aluminum or 18-8 stainless steel in pumps, valves, etc. Most of the aluminum valves are cast in alloy 356-T7 and have 18-8 type stainless steel trim. Clad 3S welding fittings and 61S-T6 slip-on flanges were employed.

The hot water system includes combination hot water heater tanks in which the water is heated by steam coils and return condensate coils. These tanks have steel shells lined with clad 3S, and clad 3S tube is used for the coils with the cladding on the water side. Tube sheets are clad 4S. House tanks are also of clad 3S construction.

In the drinking water system, aluminum alloys, primarily clad 3S, were used in the chillers, rectifiers, filters and piping.

Joints were welded wherever possible by the use of the argon-shielded tungsten-arc process. All other joints were made with 61S-T6 slip-on flanges. Integral aluminum backing rings of 72S alloy were used in the aluminum pipe welds. Filler wire was 2S throughout, except for welding the 61S-T6 flanges, in which case 43S filler was used.

The thermal insulation is borosilicate-type glass fiber throughout, and pipe hangers are either aluminum or hot dipped galvanized steel.

H., V. & A. C. Systems

Aluminum tubular products are widely used in the heating, ventilating and air conditioning systems. Primary hot water and primary chilled water are piped in separate steel risers through the core of the building, and branches are connected to supply water to the local fan rooms on each floor. The hot water is heated in steel shelled exchangers having the water inside clad 3S tubes and steam on the shell side. The chilled water is cooled in refrigeration machine chillers with clad 3S finned tube cooling coils. The chilled water is also furnished in steel pipe to the primary air conditioning units. These have clad 3S cooling coils which are separated from the steel piping by means of "protector sections."

Condenser water for the refrigeration machines passes through a cooling tower on the roof which is made of aluminum alloys with red-

wood fill. The tower is light in weight, a point particularly important when air conditioning older buildings, as they may not have been designed to support a heavy tower. Condenser water piping is steel, and the condenser on the refrigeration machine has clad 3S finned tube in it through which water passes.

Presence of copper and copper alloys in the primary hot, primary chilled and condenser water systems was minimized wherever practical, but many bronze valves and certain bronze pump parts were used. The water in these systems is treated in order to prevent corrosion of the steel, using an inhibitor system which is compatible with aluminum.

A large part of the heating and cooling load of the 30 story building is carried by the aluminum ceiling, consisting of 0.040 in. thick perforated pans clipped to ½ in., Schedule 40, 3S-H18 pipe spaced on 1 ft centers. These pipes are welded to 1¼ in., Schedule 40, 3S-F special headers having outlets drawn in them to space the ½ in. pipe automatically. The pipe lateral and header assemblies form grids which are suspended from the floor above. Water is supplied to the grids by means of 3S tubes varying in size up to 1½ in. OD. The formability of aluminum was a real advantage here, since the tubes were easily bent wherever a change in direction was required.

Water for the mains is heated or cooled in heat exchangers in the fan room. Since most floors have four zones, there are four heat exchangers in each fan room having 3S alloy shells, clad 3S tube sheets and clad 3S tubes. Connections are made by means of 61S-T6 flare fittings. Aluminum valves cast in 356-T7 alloy and having stainless steel trim were used exclusively. These are both of the automatic (pneumatic) and the manual type. There are aluminum booster coils in the corner offices for additional heating or cooling.

The panel or secondary water system just described is constructed almost entirely of aluminum alloys, with the exception that 18-8 type stainless steel is used to a limited extent in some accessories. Because this system requires little or no make-up, treated water is used in order to assure minimum maintenance.

Pneumatic Control System

The pneumatic control system in the building is extensive because of the automatic nature of the building operation. This system is essentially all-aluminum after the air dryer, which reduces the dew point of the air to prevent condensation. The tubing is 3S-0 and joints are made with aluminum compression and flare type fittings, the large majority of which are 61S-T6 alloy. Connections to dissimilar metal parts — such as brass pneumatic valves, etc. — are made without fear of galvanic corrosion because of the dry air.

While the Alcoa building is perhaps the largest single example of the variety of uses for aluminum tubular products, many of the applications are not entirely new, as smaller installations previously existed. Aluminum tube and pipe were not used indiscriminately; rather they were employed where in the opinion of Alcoa engineers they were functionally sound and commercially and economically practical.

Other Applications

Pioneering done in Alcoa's skyscraper may well point the way toward wide use of aluminum in similar applications, as engineers are rapidly becoming aware that aluminum has much to offer — not only in price and long-term availability, but also in desirable characteristics. Because of this, aluminum is building up excellent service records in many industries, including chemical, petrochemical, petroleum and food processing. Fabrication of process piping and equipment is simplified by the formability and ease of handling of the metal together with the facility with which aluminum can be joined by most commercial methods. Aluminum equipment is often used because the compounds of aluminum are colorless and, therefore, do not discolor the product. This is important in the naval stores industry, for example, where water white rosin is produced. Similarly, chemicals for synthetic textile fibers are handled in aluminum equipment to prevent discoloration of the product.

In other industries, such as the manufacture of hydrogen peroxide and the processing of edible oils, aluminum is desirable because it does not catalyze the breakdown of the product. Another reason for using aluminum for handling edible oils and in the food processing industry, in general, is that aluminum compounds are non-toxic. Because aluminum is highly resistant to concentrated nitric acid and other chemicals, such as ammonium nitrate and ammonia urea solutions, these materials are often handled in aluminum piping. An important factor in many of these applications is the strength of aluminum; mechanical properties of the standard pipe alloys in the unwelded condition are shown in an accompanying table. The heat of welding tends to reduce the tensile and yield strength to some extent. Of interest in connection with oxygen plants is the fact that the aluminum alloys exhibit no tendency toward brittleness even as low as −423 F, and several of the alloys actually exhibit increased ductility at low temperatures.

High thermal conductivity of aluminum alloys makes them desirable for the construction of heat exchangers, especially for tubes. The use of aluminum heat exchanger tubes often results in definite economy because of their low cost. In this connection, it is important to note that the suitability of aluminum for handling water is by no means limited to Pittsburgh and New Kensington tap waters. It is known that acid (pH less than 4) or alkaline (pH greater than 9) waters can be corrosion hazards, although pH alone is not necessarily a criterion. Waters containing heavy metal compounds (copper, nickel, lead, etc.) in quantities greater than about 0.1 ppm can cause pitting of aluminum, particularly in the presence of chlorides. Waters that are neutral or nearly neutral (pH in the range of 6 to 8) have little or no action on the aluminum alloys that are suitable for this service, even when substantial quantities of chloride, sulphate and bicarbonate ions are present. The presence of heavy metal compounds can be a hazard in these waters, and clad alloys would be preferred over non-clad aluminum. One of the most graphic examples of the suitability of clad 3S for use with tap water has been the satisfactory life of hundreds of thousands of clad 3S teakettles which have been in

service all over the country. Many other service data, including the performance of heat exchanger tubes, tanks, etc., supplement the teakettle experience.

Properties of Pipe, Tube

Aluminum pipe is available from warehouse stock in a wide range of sizes, as indicated in Table 1. The three alloys normally used for pipe (3S, 61S and 63S) have compositions as shown in Table 2 and mechanical properties as shown in Table 3. A new product is coiled tube made of an aluminum alloy, 50S-O, containing 1.2 percent magnesium, which is designed specifically to provide characteristics similar to those of annealed copper. It is available in lengths up to 1000 ft.

In view of the desirable combination of qualities available in aluminum tubular products, an attractive price and a good supply situation, it is not surprising that these products are being well received. With installations such as the Alcoa building pointing the way, continued increase in the use of aluminum tubular products seems assured.

TABLE 1 — ALUMINUM PIPE sizes and alloys — standard warehouse items

Nominal pipe size, in.	Schedule number*	Outside diameter, in.	Wall thickness, in.	Weight per linear ft, plain ends, lb**	Warehouse standard alloys		
⅛	40	0.405	0.068	0.085		61S-T6	63S-T6
¼	40	0.540	0.088	0.147		61S-T6	63S-T6
⅜	40	0.675	0.091	0.196		61S-T6	63S-T6
½	40	0.840	0.109	0.294		61S-T6	63S-T6
¾	10	1.050	0.083	0.297			63S-T6
	40	1.050	0.113	0.391		61S-T6	63S-T6
1	10	1.315	0.109	0.486			63S-T6
	40		0.133	0.581	3S-F	61S-T6	63S-T6
	80		0.179	0.751		61S-T6	
1¼	5	1.660	0.065	0.383			63S-T6
	10	1.660	0.109	0.625			63S-T6
	40		0.140	0.786	3S-F	61S-T6	63S-T6
1½	5	1.900	0.065	0.441			63S-T6
	10		0.109	0.721			63S-T6
	40		0.145	0.940	3S-F	61S-T6	63S-T6
	80		0.200	1.256		61S-T6	
2	5	2.375	0.065	0.555			63S-T6
	10		0.109	0.913			63S-T6
	40		0.154	1.264	3S-F	61S-T6	63S-T6
	80		0.218	1.737		61S-T6	
2½	5	2.875	0.083	0.856			63S-T6
	40		0.203	2.004	3S-F	61S-T6	63S-T6
3	5	3.500	0.083	1.048			63S-T6
	40		0.216	2.621	3S-F	61S-T6	63S-T6
	80		0.300	3.547		61S-T6	
3½	40	4.000	0.226	3.151	3S-F	61S-T6	63S-T6
	80		0.318	4.326		61S-T6	
4	5	4.500	0.083	1.354			63S-T6
	40		0.237	3.733	3S-F	61S-T6	63S-T6
5	40	5.625	0.258	5.057	3S-F	61S-T6	63S-T6
6	40	6.625	0.280	6.564	3S-F	61S-T6	63S-T6
8	40	8.625	0.322	9.898	3S-F	61S-T6	63S-T6
10	40	10.750	0.365	14.000	3S-F	61S-T6	63S-T6
12	—	12.750	0.375	17.140	3S-F	61S-T6	63S-T6

*Schedule numbers refer to the American Standard for Wrought Iron and Wrought Steel Pipe, ASA B36.10.

**Weights calculated for 61S and 63S. For 3S, multiply by 1.010. All calculations based on nominal dimensions.

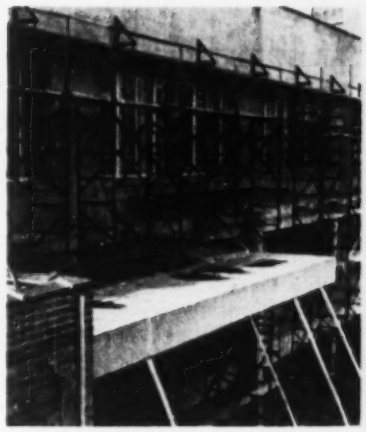
TABLE 2 — NOMINAL COMPOSITION of aluminum pipe alloys

Alloy	Percent alloying elements					
	Manganese	Magnesium	Silicon	Copper	Chromium	Zinc
3S	1.2					
61S	1.0		0.6	0.25	0.25	
63S		0.7	0.4			
72S*						1.0

*This alloy employed for cladding 3S.

TABLE 3 — TYPICAL TENSILE PROPERTIES of aluminum pipe alloys

Alloy and temper	Tensile strength, psi	Yield strength, psi	Elongation, percent in 2 in.
3S-F	17,000	8,000	35
61S-T6	45,000	40,000	12
63S-T6	35,000	31,000	12



LADDER FRAMES were used to enter the opening left by a large exterior duct (left foreground) that projected from the wall 35 ft above the base of the scaffolding.

Projecting Ductwork Complicates Scaffolding

A RECENT ADDITION to the main plant of the Minneapolis-Honeywell Regulator Co., Minneapolis, made it necessary to raise a portion of the heating and air conditioning exterior piping one floor level. The job was complicated from the scaffolding standpoint by a maze of projecting ductwork, a 9 ft pit at one spot and also required that the scaffolding working platform span adjacent one- and two-story levels.

J. McClure-Kelly and Co., heating and piping contractors on the project, used steel scaffolding, erected the entire scaffold — 120 end frames and accessory equipment — in two days, using only four men.

To clear ductwork and other permanent fixtures at the scaffolding base, 6 ft, 6 in. walk-through frames were used, leveled where necessary with extension legs and adjustment clamps. The same method was employed in the case of a 9 ft deep, 15 ft wide and 35 ft long pit at one end of the scaffolding base. A projecting duct, which allowed clearance of only 40 in. from the wall (see picture) was entered with 29 in. ladder frames, and straddled at one end with 23 ft putlogs and clamps. Tube and clamp braces were used to give additional strength where needed. Guard rails and posts at working level provided safety for workmen. [Photo courtesy Waco Mfg. Co., Inc.]

Making Hot Tap Connections

. . . . in high pressure oil and gas pipe lines reviewed at ASME petroleum conference

› › ›

THE DESIGN OF hot tap tee connections in high pressure pipe lines was discussed in a paper given at the eighth annual American Society of Mechanical Engineers' petroleum division conference held in Houston in September. The authors of the paper are A. J. Del Buono, staff engineer, P. L. Vissat, product engineer — welding fittings, and Frank S. G. Williams, manager — engineering standards, all of the Taylor Forge & Pipe Works.

Their paper presents a review of the forces acting on the branch connection in a pipe line; an analysis of the stress conditions related to such connections; suggests a design approach aimed at keeping the stress levels around branch connections in harmony with the stress levels common in high pressure pipe lines; and, finally, discusses various methods of meeting these design requirements through the use of field fabrication with or without manufactured fittings especially designed for the purpose. In addition, the authors present a digest of investigative work done by their company, and by others, bearing on this subject.

Development of a new hot tap tee for connecting branches to oil or gas lines under full operating pressure is described in some detail. This tee is designed for:

1) Carrying the full loads created by:

a) The hole cut in the line.

b) The pressure acting on the area of the branch tending to pull the branch out of the line.

c) Bending forces caused by thermal movements of line and branch, improperly supported weight, etc.

2) Installation without disturbing the original line:

a) The branch is welded to the hot tap tee before the tee is applied to the line.

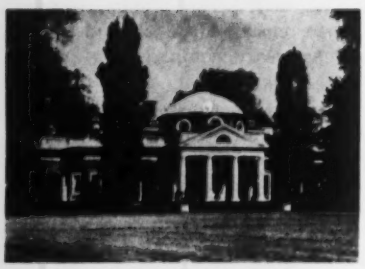
3) Safe installation:

a) The line is undisturbed until the assembly is completed. The welder does not have to make a weld that might start a rupture.

b) During the welding operations, the assembly is secured by wire cable or chains, making rupture virtually impossible.

The accompanying sketches illustrate the field installation procedure.

Historic Monticello Being Air Conditioned



PRIMARY PURPOSE of the new air conditioning installation is to protect the building and its contents, rather than to provide comfort — although that will be a "byproduct"

THE YEAR 'ROUND air conditioning installation for historic Monticello, Thomas Jefferson's unique home, is almost as extensive and is similar to the work recently completed on the White House in Washington, says the Worthington Corp.

Monticello — designed and built by Jefferson near Charlottesville, Va. — has long been a mecca for tourists. It is one of the nation's most famous buildings and has been looked upon as a classic example of early colonial architecture.

The proposed installation is unique in that it is not designed primarily for human comfort but for preservation of the increasing number of Jeffersonian relics being placed in the building. Any measure of human comfort derived will be a byproduct of the prime purpose of humidity control both during summer and winter. The air conditioning will also help preserve the unfurred heavy masonry walls and timber framing, which have suffered from condensation in the summer and frost action in the winter.

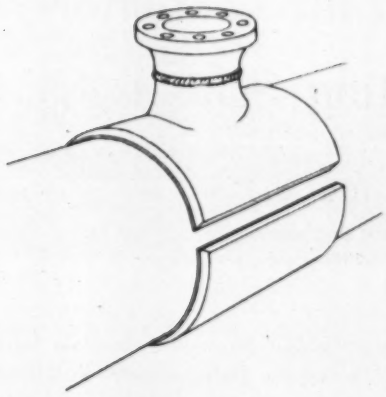
The air conditioning equipment will be in the basement, directly beneath the famous octagonal drawing room. It will provide conditioned air for the first floor public area of the historical shrine and the second floor area.

Prime consideration was given to the interior appearance of the air conditioning system. Supply air grilles are completely concealed in order to maintain the original interior decorations intact.

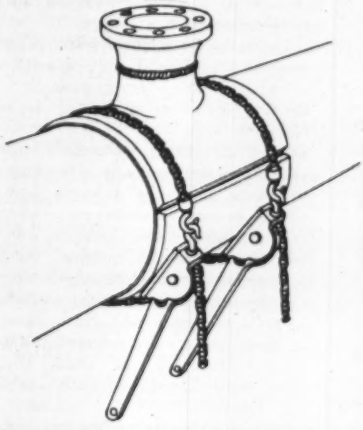
A distinctive feature of the installation is the fact that existing chimneys and the original fireplaces will be utilized in each room for return air circulation and distribution.

Milton L. Grigg is the architect for the restoration project and Wiley and Wilson are the engineers, with R. E. Lee and Son the general contractor and Wachter and Wolff the mechanical subcontractor.

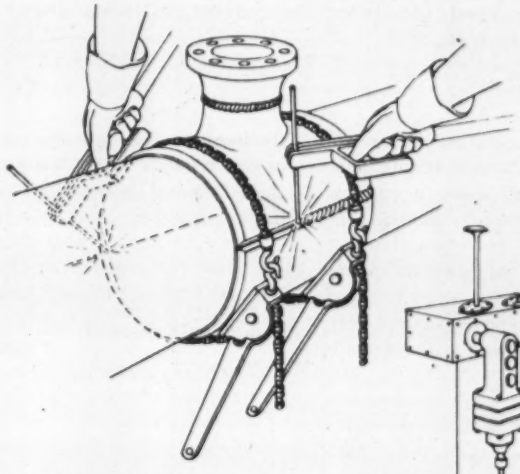
1 HOT TAP TEE and welding neck flange



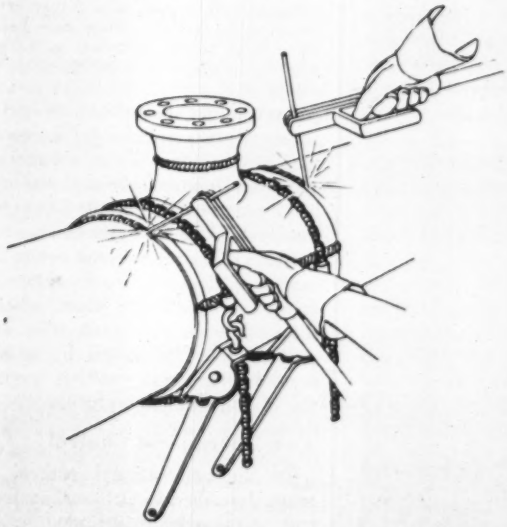
2 FLANGE WELDED TO HOT TAP and assembly positioned for "vertical tap." If the condition calls for a "side tap," it is assembled with one longitudinal joint on top and the nozzle at 180 deg from the final position. It is clamped in this position, using 1/16 in. thick mild steel strip, to back up the longitudinal weld and complete the longitudinal weld. The clamps are loosened, the hot tap tee is rotated to the final position, and reclamped. The remaining longitudinal weld, which will then be on top of the run, is then made



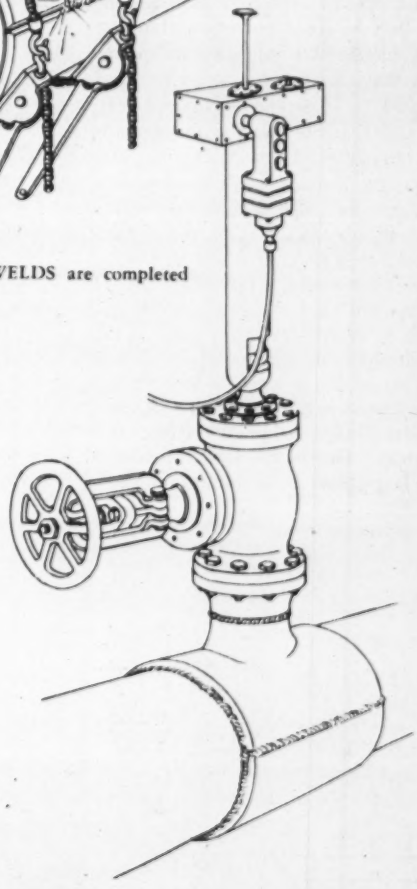
3 IF THE BRANCH is located on top of the run ("vertical tap") then the tee is positioned and clamped as shown in this sketch, with or without backing strip



4 LONGITUDINAL WELDS are completed as indicated here



5 CIRCUMFERENTIAL WELDS are then made, and the clamps removed



6 VALVE AND HOT TAP CUTTER assembled and ready to make line tap

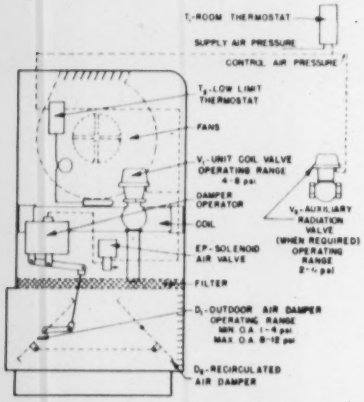
Controlling Unit Ventilators for Heating Schools

By Harold W. Alyea
Chief Field Engineer
Johnson Service Co.

Developments in unit ventilators and improved controls have resulted from the growing trend to build school buildings with extensive glass areas. This second article of a group explains the need for these improvements, what they are, and how they work.

MAINTAINING a constant room air temperature with a unit ventilator is not difficult when using a conventional control system, assuming that the unit is sized correctly, that the room thermostat is located with care, and that the control valve is sized properly. However, it is not only necessary to provide a uniform room air temperature, but proper air distribution and the absence of drafts are equally important for comfort.

Good air distribution throughout the room is assured if the unit is located correctly, diffusing outlet grilles are used, and no obstructions such as beams are in the path of the discharge air which might deflect the air to the occupancy level before it is properly diffused with room air. Drafts may originate from two sources. One of the most common is the large glass areas found in modern classrooms. As the room air comes in contact with these glass areas it is chilled and drops, causing a down draft. Another source is the discharge air stream, which often is below room air temperature when large internal heat gains are dissipated.



1 TYPICAL DRAW-THROUGH unit ventilator with control system. Such units are usually installed on the floor below the windows

Low Limit Control

These low discharge temperatures occur when the internal heat gain in the room causes the room air temperature to rise above the thermostat setting, after which all controlled sources of heat are shut off. To prevent the introduction of air into the room at a temperature too low for comfort, a low limit thermostat is generally provided. The setting of this thermostat is usually between 55 and 60 F, since air at these temperatures can be introduced into the room without causing drafts if it is diffused properly at the outlet grille.

Drafts are more objectionable under conditions of varying discharge temperature than when the temperature is constant. Air can be introduced at a constant 60 F without noticeable effects, while if it varies between 60 and 80 F, drafts may be objectionable even though the average temperature of the discharge air is 70. Therefore, it is important that the discharge air temperature remain stable.

Cycling Discharge Temperatures

In most unit ventilator installations, there are several factors that cause unstable or cycling discharge air temperatures:

1) *Room thermostat location.* The thermostat must be placed where there is good air circulation, so that it can quickly sense any changes in the space temperature. Good results are usually obtained if it is located on the inside wall directly across the room from the unit. Where large rates of outdoor air are introduced and an exhaust outlet is necessary, the thermostat located near this outlet usually provides an effective means of obtaining rapid response to average room temperature.

2) *Lags in the system.* These may be classified as: (a) Velocity — distance lag, or the time required for the air discharged from the unit to reach the room thermostat. (b) Capacity lag, or the time required for a change in discharge temperature to effect a change in room air temperature. Other less important lags also exist, but these are the most important in causing unstable or cycling discharge air temperatures.

3) *Size of the control valve.* The valve must be sized for full unit capacity, which is required only during warm-up. Thus, the valve is necessarily too large for normal operation and tends to produce cycling. Correct valve sizing is extremely important, and a minimum amount of cycling is experienced when the valve is just large enough to meet maximum requirements.

4) *Variable steam pressure.* In most low pressure steam systems, the boiler operates on pressure control, starting when the pressure drops to 2 psi and stopping when it reaches 5 psi. Such fluctuations in steam pressure are reflected in discharge temperature variations which keep the room thermostat upset continuously.

5. *Variable return line vacuum* — On vacuum return systems, the vacuum pump operates intermittently, with the vacuum varying between 5 and 10 in. of mercury, for example. This variation in vacuum has the same effect as the variable steam pressure.

A further discussion of some of these variables will appear in a future article. Attention is called to them here because all of these factors contribute to the problem of obtaining a uniform discharge temperature.

Every unit ventilator, therefore, presents two temperature control problems. One is to control the room air temperature and the other is to control the unit discharge temperature. The first problem is solved by using a conventional room thermostat. Since the room thermostat cannot immediately sense what is happening in the unit, the other problem can be solved by using a second thermostat which controls the discharge temperature.

Two Thermostat Control

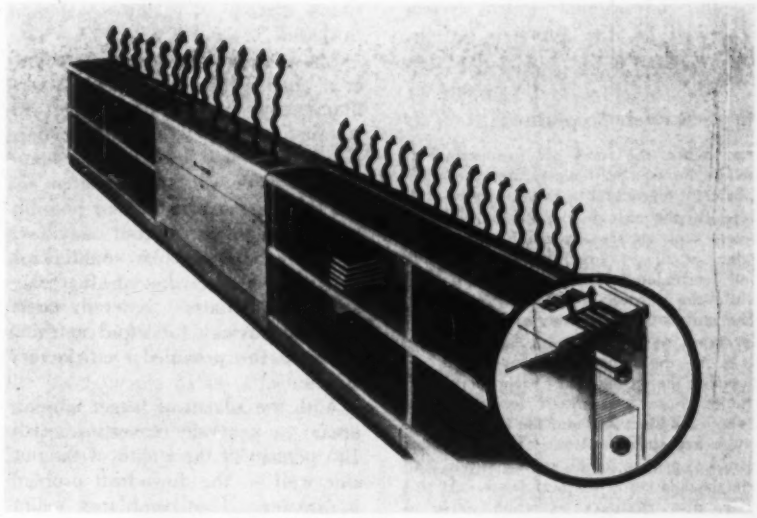
In the conventional control systems, described in October, each control arrangement included a low limit thermostat in the unit discharge air stream to prevent the air from being introduced into the room at

too low a temperature. However, this thermostat functions only when the room heating requirements are satisfied and control of the minimum discharge temperature is required. If this thermostat could function over the entire range of the unit output instead of just as the low limit control, the problem of maintaining uniform discharge air temperatures would be solved. Such a control is available and is generally called a submaster thermostat. The setting of this control is determined by the control pressure from the room or master thermostat.

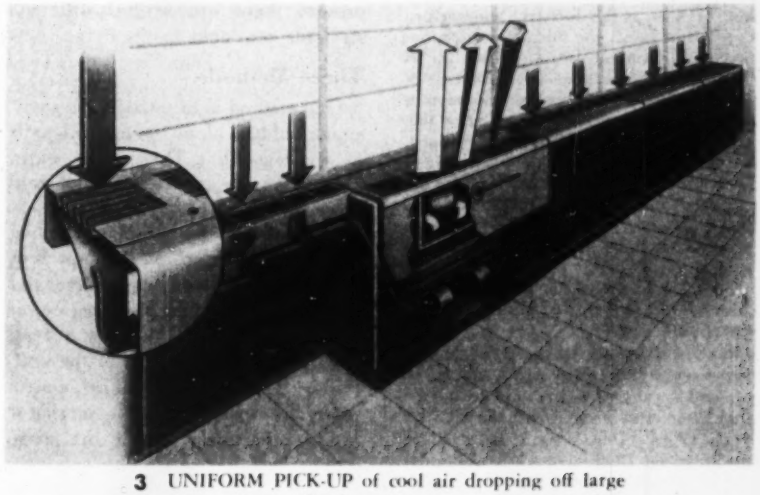
In this dual control system, the room thermostat has complete control of the space temperature at all times, by virtue of its ability to adjust the submaster discharge thermostat to whatever temperature is required. The submaster thermostat at the same time has complete control over the discharge temperature at whatever value is dictated by the room thermostat. Thus, the lags necessarily associated with a unit ventilator system are not experienced with this control arrangement because the bulb of the controlling thermostat is located directly in the discharge air stream, where changes of temperature are immediately detected. Furthermore, rapid correction for such variables as steam pressure, return line vacuum, increase in heat loss or gain is realized, and as a result their effects on the discharge temperature are minimized.

The room air temperature control obtained with the conventional control arrangements is within acceptable limits; however, the master-submaster method, besides eliminating the possibility of drafts due to variations in discharge temperature, produces results with practically no variation in room air temperature. Since most variations in room air temperature are caused by the cycling of the unit discharge temperature, more uniform room air temperatures are achieved because the control of the unit does not have to wait until temperature changes occur at the room thermostat.

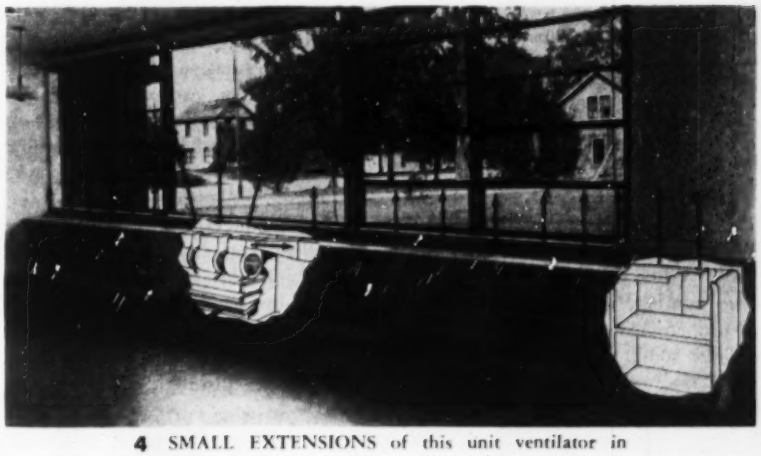
The master-submaster method of unit ventilator control is adaptable to all of the standard control systems and differs from the conventional control arrangements only in that the low-limit thermostat is replaced by a submaster discharge thermostat. The control diagram is the same as



2 SILL-LINE RADIATION, an integral part of this unit ventilator, permits delivery of warm air over entire length of glass area



3 UNIFORM PICK-UP of cool air dropping off large glass areas is provided by using narrow ducts extending from both ends of this unit ventilator



4 SMALL EXTENSIONS of this unit ventilator in both directions deliver warm air uniformly under extensive glass areas

for the conventional control system described in the previous article, and is repeated as Fig. 1 for convenience.

Typical Cycle Explained

1) When the room air temperature is below the control temperature, the room (master) thermostat pressure is zero. As a result, the unit (submaster) thermostat receives no supply air, and the unit coil valve, auxiliary radiation valve (if any) and recirculated air damper remain open while the outdoor air damper is closed. The unit is then operating at full capacity for rapid warm-up.

2) As the room air temperature approaches the setting of the room thermostat, the pressure transmitted by the room thermostat increases, and the system comes under automatic control. The outdoor air damper opens to its minimum position, and the room is ready for occupancy. At this time, the auxiliary radiation valve is closed.

3) A continued rise of room air temperature then causes the unit heating coil valve to modulate toward its closed position. As soon as the discharge temperature drops below 120 F, the submaster discharge thermostat assumes control. When air is supplied from the room thermostat at 9 psi, the submaster thermostat maintains a 120 F discharge temperature. Since this temperature will be too high for occupancy, the room thermostat pressure will continue to increase above 9 psi and reduce the setting of the submaster thermostat proportionately. At 14 psi, the submaster thermostat will be controlling at the low limit of 60 F. Any further increase in pressure from the room thermostat will cause no further reduction in the discharge temperature.

Under normal operation, when any discharge temperature between 60 and 120 F will satisfy the room requirements, the room thermostat pressure will be between 9 and 14 psi. During warm-up, or if for any reason the 120 F discharge temperature is insufficient, the room thermostat pressure will drop below 9 psi, and the room thermostat will assume control.

4) The sequence of control is exactly the same as for the standard control cycles previously described. After the unit coil valve is completely closed, the outdoor air damper modulates from its minimum to its maximum position until 100 percent outdoor air is available for cooling if required.

Large Windows Present Problem

There is a growing tendency on the part of architects to design schools with window areas as large as possible. While this insures better daytime lighting, it presents a problem in proper heat distribution throughout the room. Room air in contact with the cold windows becomes chilled, its increased density causes it to flow downward, and it is replaced by warmer and lighter air. This continuous downdraft generally causes discomfort to those seated in this area.

The downdraft is effectively countered, in the vicinity of the unit ventilator, by the unit discharge air stream. If the window area does not include too large a percentage of the outside wall area, as often was the case in the past, one or possibly two strategically placed auxiliary radiators or convectors could eliminate the rest of the downdraft. Since auxiliary radiators generally were required anyway for rapid morning warm-up, this provided a satisfactory solution.

With the advent of larger window areas — generally covering nearly 100 percent of the length of the outside wall — the downdraft problem is greater. Unit ventilator manufacturers have recognized the window downdraft problem and have developed means for solving it. At present there are several different methods available.

Three Methods

One method is to introduce a small amount of heat along the entire length of window sill. This rising warm air serves to neutralize the cold downdraft.

This sill-line radiation is supplied as an integral part of the unit ventilator, with matching enclosures, and — depending upon the location of the unit ventilator — may extend from either or both ends of the unit. Piping connections and the control valve are inside the unit ventilator end compartment, using the same supply line that serves the unit ventilator coil. Fig. 2 shows a unit of this type.

For most of the unit ventilator cycles, this sill-line radiation is controlled in the same manner as the auxiliary radiation used with conventional units, except that the operating range of the control valve is selected so that the sill-line radiation remains on as long as any heating is required.

Where integral utility cabinets are furnished with the unit ventilator, the cabinets are built to incorporate the sill-line radiation. Room air passes underneath and in back of the cabinets, through the sill-line heating unit, and out through a grille in the top.

Another method of combating the effects of window downdraft is to collect the cold air at the sill and take it directly into the unit ventilator. This system uses narrow ducts which extend from one or both ends of the unit, and arranged within the unit so that the fans pull air directly from the window sill. Design of the ducts and inlet openings provides uniform air pick-up over the entire length. This type of unit is shown in Fig. 3. Matching utility cabinets, if used, are designed to incorporate these ducts as an integral part of the cabinets.

In the third method, small extensions under the windows from both ends of the unit, as indicated in Fig. 4, distribute air upward to counteract the downdraft. Where utility cabinets are used, these extensions are built into the cabinets. Separate fans, mounted on the common fan shaft, supply a constant amount of air to each of these extensions. The air velocity and the design of the outlet openings permit a considerable quantity of room air to be entrained along with the discharge air, the entrainment ratio being about 5 to 1. A large portion of this entrained air is from the window downdraft, which prevents it from spilling into the room. The remaining portion comes from the occupied area of the room and helps to create a flow of air toward, rather than away from, the windows.

The latter two arrangements are accomplished without any change in the control system or in the cycle of operation.

[In the next article, the use of unit ventilators on hot water systems will be discussed, with particular reference to various methods of controlling the water temperature, reasons for zoning, and precautions required to prevent freezing the water in the unit ventilator coils. The three photos this month are reproduced through the courtesy of American Air Filter Corp., Herman Nelson Div.; John J. Nesbitt, Inc.; and The Trane Co.]

Dr. Philip Drinker Again Honored

DR. PHILIP DRINKER, Harvard University professor, has been given the sixth annual Industrial Health Conference's award for the most outstanding contribution to the field of industrial hygiene. He is the inventor of the iron lung.

Dr. Drinker is a long-time member of HPAC's board of consulting and contributing editors.

THE LAW AND YOUR PROFITS

Caught Between Contracts

COSTLY TROUBLES may lie ahead if you, as a contractor, depend upon a client-contract and your suppliers to protect you in your effort to satisfy a customer by removing a first installation to replace it with other equipment.

In a thriving southern city the owners of the Feesimple Tourist Hotel (the names herein are imaginary) contracted with the Moddun Co. for an air conditioning system which was comprised of two 7½ ton air conditioning units to be installed by the contractor. After installation, these units were found to be "faulty and defective." Acknowledging this fact, the Moddun Co. removed the equipment and replaced it with two 5 ton units of another make. Operation of the new units proved to be "efficient and acceptable." Therefore, Feesimple paid Moddun the sum agreed upon in the contract — with the exception of $818. However, there had been no formal acceptance by Feesimple because the contract stated that the units were to be *installed and tested* before acceptance.

After the replacement units were installed, Feesimple had to have the wiring altered so that they would function properly. This cost him $274, but he was even more concerned when he discovered that the two 5 ton replacement units were less valuable than the larger 7½ ton units by about $3000. To this difference he added his cost for the wiring and other costs and sued Moddun for a $3390 overpayment.

The defendant contractor, Moddun, then counterclaimed for his $818 unpaid balance and for $1964 which was to cover the materials and labor for the installation of the first two units. In addition, Moddun called on the manufacturer to reimburse him for the original units that proved to be defective.

In the trial court, Feesimple went before a jury and was awarded $2909 while Moddun received $1490. This verdict left the contractor owing the hotel people $1500 after adjustment of court costs. Both parties then appealed on the portions of the judgment that were distasteful to them.

The state supreme court attacked this case with characteristic coolness. To begin with, it noted that the contract not only called for *purchase* of the air conditioning units, but in addition provided that they were to be *installed and tested*. The court held that "This was not a contract that contemplated transfer of equipment, because the units were to be permanently installed and tested," — as therein agreed. "There was no acceptance, and after operation, they proved a failure." Furthermore, the first units were removed by Moddun from Feesimple's premises with the hotel owners' "complete acquiescence." "Therefore the *original contract*" for the first units "*was mutually rescinded.*"

The supreme court laid things on the line — a contract legally entered into has force and effect of law between parties thereto, and may be revoked by mutual consent. The contract for the first units had been so revoked, because the installation had never been accepted.

This situation, implied the court, left Moddun without a contract and thus owing Feesimple a refund of what had been paid. The jury's finding to that effect (concurred in by the trial judge) was approved by the higher tribunal, which observed in a judicial statement aimed at the unfortunate air conditioning firm — "This is the law."

Thus, Feesimple recovered his overpayment and Moddun received part of his much smaller claim covering the substituted equipment, with the net result that the contractor was out of pocket about $1500 plus his proportion of the court costs.

As for getting anything out of the manufacturer, the air conditioning firm was turned down on that also. To allow a "personal call in warranty," said the court, there must be an obligation, either expressly contracted or legally imposed, to pay a debt due by one person to another. In this case there was no such obligation on the manufacturer's part.

How could Moddun have protected himself in this sad affair?

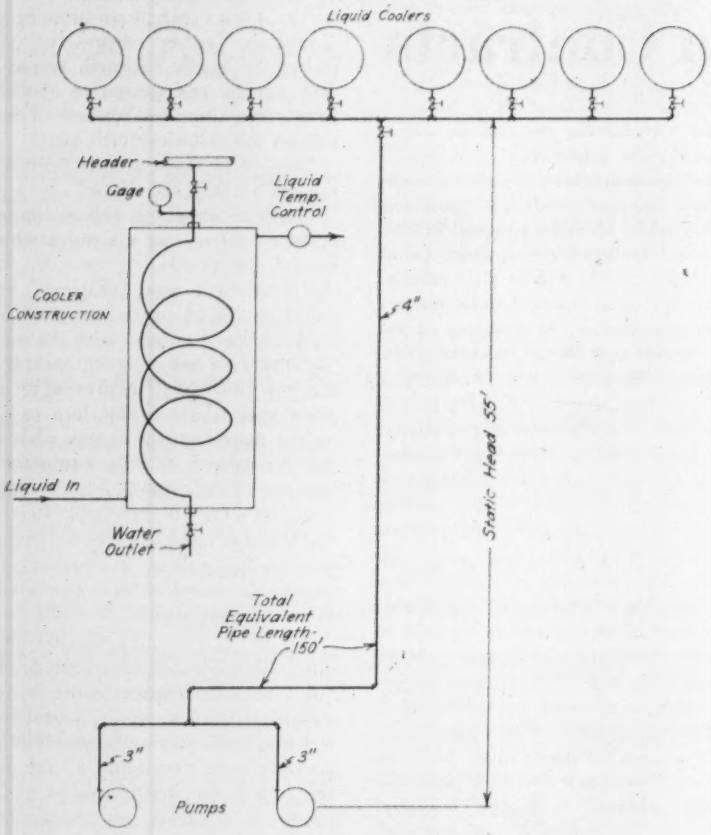
First, he should not have undertaken to deliver an assurance which he did not possess — namely, that the equipment was "efficient" and therefore would prove "acceptable." Lacking direct contact with the manufacturer, he had no such assurance nor any "warranty," expressed or implied, that would enable him to call on the manufacturer to pay what he lost by reason of the equipment's failure. Furthermore, and aside from the merits of Feesimple's claim, the Moddun company jeopardized its position by making it necessary for the hotel owner to alter the wiring at his own expense.

All along, it would seem that Moddun took too much for granted. He fell into this common error by assuming that his suppliers would protect him as to guarantee and that his contract with Feesimple would protect him in the substitution of equipment. A contract, no matter how exacting as to terms and performance, is not in itself a durable commodity. An apparently trivial deviation, particularly if acquiesced in by both parties, may constitute a "novation" or even shatter the agreement beyond repair. That is what happened when Moddun replaced the units. He was left with no definite contract at all. His monetary rights were therefore passed upon by a jury, whose award was according to their views and understanding of the facts.

He has doubtless learned that the slightest departure from a contract is a matter to be passed upon by his attorney, who would have reminded him of a well-known principle of law. In the words of another court: "The parties to a contract may rescind it at any time . . . the surrender of their mutual rights and the *substitution* of new obligations constitutes a sufficient consideration."

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

William Hurd Hillyer, author of this article, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.



1 PUMP AND PIPE connections, and construction details of the coolers

New Piping Improves

. . . a big process plant's operation, saves pumping power. Basic reference information given

By Thomas G. Thurston
Consultant

• *Almost anything can happen when you're in the engineering, operating, contracting or sales ends of the heating, piping and air conditioning industry. The objective of this more-or-less regular editorial feature in HPAC is to discuss the solution of practical problems.*

Mr. Thurston has had many years experience as a consulting engineer and has served as director of the engineering advisory council for a national association of operating engineers for over 20 years.

SOME OF THE MOST PUZZLING problems encountered by the operating engineers of an industrial power plant, or the service plant of a building, involve the failure of centrifugal pumps to deliver the output for which they were installed. When pumps operate at capacities and efficiencies far below the performance for which they were designed, unsatisfactory operation and increased costs result.

The design of a successful and efficient centrifugal pumping system can become quite involved in many cases if the designer does not have a clear conception of the characteristics of the different types of centrifugal pumps and the principles of fluid flow in piping. This was strikingly demonstrated by a recent experience in a large chemical processing plant.

Large Processing Plant

Part of the process involved the cooling of a given quantity of liquid solution to a specified temperature each minute, which in turn went into another mixture in the next step of the process. The liquid was cooled in shell and coil units with chilled water being circulated through the coils. The design of the coolers and the piping system is shown in Fig. 1.

The cooling units were designed to cool the chemical liquid at the required rate and to the proper temperature by forcing chilled water through the cooling coil at the rate of 100 gpm. The design called for a pressure drop of 10 psi from the inlet to the outlet of the coils.

The temperature of the liquid leaving the chiller was controlled automatically by regulating the flow of the chemical solution through the chiller so as to maintain the proper outlet temperature. The quantity of liquid cooled was dependent upon the rate at which the chilled water was circulated through the cooling coils. If the rate of chilled water circulated and the temperature were held constant, the amount of liquid cooled per minute would also remain constant. However, if the quantity of water circulated per minute was varied, the thermostatic control would vary the output of the liquid proportionally.

It was essential that the cooled chemical solution be delivered to another stage in the process at a closely controlled rate. Consequently, it was important that the output from the coolers be held constant. To accomplish this, the temperature and quantity of water circulated through the coolers had to be maintained close to the specifications.

Piping Shaved

The plant had been built during the closing months of World War II, when so often it was not a matter of choosing the right equipment, but a problem of getting any kind of equipment that would serve the purpose. Piping was both scarce and expensive, so the piping installation was "shaved" wherever possible.

Only half of the cooling units were installed at first, with the expectation that the remainder would be installed later. However, two centrifugal pumping units were included in the original installation, which provided a spare unit in case trouble was experienced with the pump carrying the load.

The system operated satisfactorily during the first year. There were a few times when the single pump failed to maintain the 10 psi pressure at the chillers when the voltage on the overloaded line which supplied the motors for the pumps dropped below normal. Of course, this difficulty was easily remedied by starting the second pump, which brought the pressure back to normal.

Discharge Pressure Too Low

Trouble was encountered as soon as the second half of the installation was completed and placed in operation. Doubling the capacity of the plant required double the original amount of water. With both pumping units and all the liquid coolers in operation the water pressure at the inlet to the liquid coolers was below 5 psi. With one pump in operation and half of the coolers in service the discharge pressure at the pump header was approximately 41 psi. With both pumps in operation and all coolers in service the discharge pressure only went up to 44 psi.

The obvious conclusion was that the discharge pressure of the pumps had to be increased. That posed the next question — how much should the pressure be increased?

Determining Pump Head

From the blueprints it was found that the static head from the pump discharge to the distributing header at the coolers was approximately 55 ft. To check this, the suction valve at one pump was closed after it stopped while the other pump remained in operation. Then the discharge valve for the running pump was closed, thus insuring a column of water in the line from the supply header at the coolers to the suction valve of the pump. Also, a connection on the cooler supply header was opened to check if it was full.

The gage on the pump discharge header showed a pressure of 25 psi which corresponds to a head of 58 ft. Since this value checked closely with the blueprint figure of 55 ft, it was concluded that a head of 55 ft could be used in the calculations.

The total length of the 4 in. pipe line from the pump discharge header to the supply header at the coolers was 150 ft. This included allowances for elbows and valves in the line. The next step was to determine the friction head in the line.

Each one of the cooling units was designed to use chilled water at the rate of 100 gpm at a pressure difference between inlet and outlet of 10 psi. There were eight coolers in the completed installation, and four in the first part of the installation. The test was made on the first half, which had operated satisfactorily with one pump in operation. With the four coolers in operation the flow through the line should have been 400 gpm.

By throttling the pump discharge valve slightly the pressure on the supply header at the coolers was adjusted until the specified pressure of 10 psi was obtained; this corresponds to a 23 ft head. Adding this to the 55 ft static head made a total of 78 ft.

With the discharge from the pump partly throttled, the pressure gage on the pump discharge header indicated a pressure of 40 psi which corresponds to a 93 ft head. With the pressure on the supply header and the static head totaling 78 ft, the friction head in the line would be 93 — 78 or 15 ft.

What About Pressure Loss?

The pressure loss in piping, or the pressure required to drive water through a pipe, varies with the *square of the velocity*. If the flow is *doubled*, the pressure required to drive it through the line is increased *four times;* if the flow is tripled, the pressure has to be increased *nine times*. This is a point that is frequently overlooked in designing and operating pump and piping systems in many industrial and institutional plants.

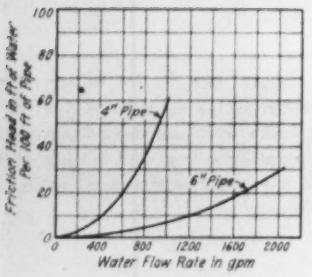
In this case, with a friction head of 15 ft on the line at a flow rate of 400 gpm, the velocity would have to be doubled to deliver 800 gpm. Doubling the velocity would increase the friction head four times, from 15 ft to 60 ft — and the total head on the pumps would be increased to 78 + 60 or 138 ft. To insure adequate water flow under full load operation of the system, even with reduced voltage on the motors, the pumps should have been designed for a friction head of 150 ft at the required capacity with the 4 in. piping system installed.

When the name plates on the pumps were checked, it was discovered that the rated capacity of each was 500 gpm against a head of 85 ft. Evidently, the capacity of the pump had not been exceeded at 400 gpm, with the head of 93 ft when only one half of the system was in operation. With the discharge valve closed, the pumps showed a pressure of 45 psi, corresponding to a head of 104 ft. No matter how many pumps of the same type and capacity would have been installed, only a little over half the normal full load requirements could be delivered with the existing pump installation. The first reaction by most members of the plant staff was that new pumps should be installed.

Piping Loss Too High

At this stage of the diagnosis of the problem, it became apparent that the bottleneck was in the 4 in. pipe line and not in the pumps. If the friction loss in the piping could be reduced to about 10 ft at full load, the existing pumps would have ample capacity.

A study of charts and tables available on the flow of water in piping revealed that an increase in the pipe diameter of 50 percent, from 4 to 6 in., would permit 800 gpm to be delivered with a friction loss of about 5 ft for a 100 ft length of pipe, or 7.5 ft for 150 ft. This was a surprise, but after checking and double



2 FRICTION LOSS in 4 in. and 6 in. pipes, 100 ft long, for different capacities

checking it was decided that a 6 in. line should replace the 4 in. line. With the 6 in. line the total head on the pumps would be 78 + 7.5 or about 86 ft, which indicated that some reserve capacity would be available to meet a greater demand or an increase in the total head.

New Piping Saves Power

There was an important advantage in replacing the pipe line. A flow of 800 gpm is equivalent to 6664 lb of water. If this amount of water is discharged against a 140 ft head, which would be the case if new pumps had been installed, the discharge would total 933,000 ft-lb or the equivalent of 28.3 hp. The same quantity discharged against a 90 ft head, to be liberal, through the new pipe line would total 600,000 ft-lb or the equivalent of 18.2 hp. This difference of 10 hp is appreciable. Assuming that the average pump and motor efficiency is 60 percent for a unit of this size under these operating conditions, the power input would have to be 17 hp greater or about 12.5 kw. In 24 hr operation additional power totals 300 kwhr — which at 1c per kwhr gives a total of $3 per day. In 100 days, it adds up to $300. At this rate the cost of changing the pipe line would be returned in savings in a short time and would continue to pay dividends as long as the line continued in service under the same conditions.

Proof of Solution

The most pleasant experience came when the system with the new line was put into operation. With all eight coolers in operation the 10 psi pressure could be maintained at the cooler inlets with a pressure of about 37 psi on the pump header, corresponding to an 86 ft head. The friction loss in the piping was only 86 −78 or 8 ft. Twice the amount was being delivered through the new 6 in. line with 7 ft less friction loss — with capacity and head to spare.

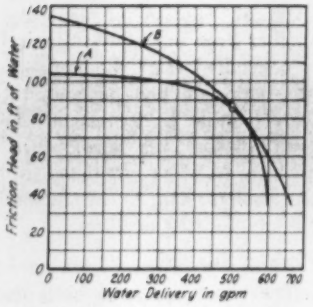
One reason for the low friction loss was that long radius 45 deg ells and Y fittings were used instead of tees whenever possible in making up the line. Most of the connections were welded, and where screwed connections were used special care was used to ream the pipe ends to almost a feather edge — even the edge was rounded off with a file to make the joint a smooth surface. Gate valves were substituted for the globe valves used in the 4 in. line.

Capacity of 4 In. vs. 6 In.

The relative capacities and friction losses for 100 ft lengths of 4 in. and 6 in. pipe are shown in Fig. 2. Of course the friction loss varies in direct proportion to the pipe length. The relation of capacity to friction loss is not so simple, as will be noted by referring to the graph. It varies *directly* as the square of the velocity and *inversely* as the diameter. If the rate of flow is *doubled*, the friction loss is increased four times. However, if the pipe diameter is *doubled* while the *velocity remains constant*, the friction loss is reduced *one-half*. It is obvious from these proportions that a small change in pipe size, particularly in the smaller sizes, results in a radical change in the friction loss. Consequently, it is usually good engineering practice to use liberal pipe sizes for most services. It takes additional power to maintain flow against a high friction head — and if the head is excessive, the extra power cost will soon pay for a larger piping system, as illustrated in this case.

Effect of Pump Characteristics

One more point should be mentioned in connection with problems of this kind. Most centrifugal pumps fall into two major classifications, as far as head and capacity are concerned — a *flat* head-capacity characteristic, *or* a *steep* head-capacity characteristic. In the flat head-capacity type, the head remains practically constant from no discharge to



3 CHARACTERISTIC HEAD-CAPACITY curves for centrifugal pumps, "A" showing a flat characteristic and "B" a steep characteristic

50 or 60 percent of rated capacity, after which the head drops as the capacity is increased to its full load rating. This is illustrated by curve "A" in Fig. 3, which shows the head-capacity curve for the pumps used in this discussion. Curve "B" in Fig. 3 shows the head-capacity characteristic of a pump designed for the same full load capacity and head, but with a *steep* characteristic. It will be seen that the head rises steadily as the capacity is reduced, until at no load it is about 50 ft higher than the head at full-load capacity.

Referring to the curves in Fig. 3, for instance, if at any time the head increases to 105 ft, the pump represented by curve "A" will stop pumping while the pump represented by curve "B" will still deliver approximately 400 gpm and will even deliver around 350 gpm against a 110 ft head. If there is any doubt about the calculations of the head and capacity in making up specifications for a new pumping system — or if there are prospects of considerable variations in the head while the pumps are in operation — or if additional capacity may be required at a later time, the pump with the steep characteristic should be selected. Pumps with a flat characteristic will be the most economical to operate where the head remains constant within narrow limits. If there is any doubt about what type of pump to use, the manufacturer should be consulted, as impellers can be designed to successfully and efficiently operate under any number of difficult conditions.

Consider the Factors

It cannot be too strongly emphasized that before any attempt is made to increase the flow through a pipe line permanently, the actual friction loss under existing conditions should be accurately determined. If the friction head is low and the static head high, there may be no difficulty. If the reverse is true, it may be impossible to force the increased volume through the system with the existing equipment.

For most water piping systems in industrial plants and other large buildings, the size of the main lines from the pumps or supply centers to the distribution points should be based on a friction loss of 1 or 2 psi per 100 ft of pipe, or at the most, a 5 ft head. Then, if there is a need for additional capacity, the flow can be increased without a prohibitive increase in the friction head resulting in excessive pumping costs or in expensive modifications of the piping systems.

Practical Reference Table

Practical reference figures for checking piping systems, or for designing new piping systems, is presented in the accompanying table showing the relations between velocity and friction loss in different sizes of piping. The table shows the velocity of flow produced by a pressure drop of 1 psi in 100 ft of clean pipe. Remembering that the friction loss varies directly as the length of the line and as the square of the velocity, it becomes a simple matter to estimate the approximate friction loss for any length or any velocity, for the range of pipe sizes given.

RELATIONSHIP OF VELOCITY AND FRICTION LOSS in different sizes of piping

Values given are based upon pressure drop of 1 psi per 100 ft of pipe.

Pipe size, in.	Velocity, fpm	Capacity, gpm
1	120	5
2	180	32
3	240	85
4	282	185
5	312	325
6	360	550
8	420	1100
10	510	2200
12	600	3500

Data are based on clean pipe without corrosion, scale or deposits. The friction loss will be higher with corroded and scaled pipe.

Referring to the table, if it is desired to deliver 64 gpm through 200 ft of 2 in. pipe, the friction head will be twice that shown on account of the doubled length. Also, this head will be increased four times because of the doubled velocity which gives a result of eight times the figure in the table, or 8 psi. This illustrates the importance of keeping the friction head low in new installations. If we had started out with 5 psi friction head in the above problem and then doubled the length and velocity, a pressure of 40 psi would be required to drive the water through the pipe, and power costs would climb at the same rate. The same relations apply to all other pipe sizes, and this makes it comparatively simple to determine what the result may be if changes are made in existing installations.

Many reference books and manufacturers' bulletins recommend velocities up to 600 fpm for centrifugal pumps, without any qualification regarding the pipe size. Many engineers follow the same rule in the design of a piping layout. The assumption applied is that the friction loss remains the same for a given velocity, regardless of the pipe size. This is not the case as will be seen from the table. In a 1 in. pipe 1 psi will produce a velocity of 120 fpm; in a 10 in. pipe 1 psi will produce a velocity of 510 fpm. A velocity of 600 fpm in a 1 in. pipe 100 ft long will require a pressure of about 25 psi to drive the water through the pipe — for the 4 in. pipe about 4.5 psi would be required — for the 8 and 10 in. pipes a 600 fpm velocity is all right, although the friction head will rise to 2 psi in the 8 in. pipe. The variation in the allowable velocity is based on the fact that the friction loss varies *inversely* as the pipe diameter — the larger the diameter the lower the friction loss. If the diameter is doubled, the friction loss is reduced one-half providing the velocity remains constant in both cases.

These are practical figures that I have used for checking existing installations, or checking the design of a new line or pumping system. Mathematical accuracy down to fractions of 1 percent is not essential as there are too many variables in such problems which make such computations impractical. The rules and data presented are primarily for checking purposes. If they are intelligently applied, they will provide the right answers to most practical problems encountered in the average industrial and institution piping system.

Engineer's Job Is Social As Well As Technical

THE ENGINEER'S JOB is a social as well as technical one, and he has a special obligation to participate in civic affairs in which good engineering is a vital factor, Carey H. Brown, manager of engineering and manufacturing services, Kodak Park Works, Eastman Kodak Co., told the fall meeting of the American Society of Mechanical Engineers, at Rochester, N. Y.

Calling on industry to bring out the best qualities of the engineers it hires, Carlos E. Harrington, chief engineer, Winsmith, Inc., speaking at the same meeting, asserted that engineering schools in this country are turning out uniformly well-trained graduates who have a keen appreciation of engineering principles.

The broadening of the engineer by conferences might be extended by his activity in engineering societies, where he can discuss his problems with fellow engineers. "To management this has a sales advantage, because it presents its name to those who, to a great extent, influence purchasing. Aside from the broadening effect on the engineer himself, it acquaints a very select group with the activities and product of his sponsor," Mr. Harrington stated.

The engineer can be developed by encouraging him to take part in affairs of his community. "The better a corporation is known in its home town, the easier it is to get satisfied workmen and an interested attitude of local government toward the company in its midst," he said.

QUESTION OF THE MONTH

How Much Does Air Conditioning Boost Office Efficiency?

• *IF YOU DON'T HAVE the answer to a heating, piping or air conditioning problem, chances are someone else does — or can be helpful on part of it. That's the reason for HPAC's Question of the Month "idea exchange."*

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

• *RECENT QUESTIONS have been asked about the specific advantages of air conditioning office space, as such information is useful in justifying the investment in a proposed air conditioning installation. The following comments give useful information on this matter. Further data along the same lines for future publication will be most welcome.*

L. B. PETERSON —

"Can Expect At Least a 10% Production Increase"

IF HPAC COULD develop definite data concerning the increase in office efficiency through air conditioning, I am confident it would be of inestimable value to companies considering installing air conditioning.

Several years ago I made a study as a basis of proposing installation of air conditioning in the design departments of the company with which I am connected. There are approximately 800 people in the design departments alone and 400 in the related office departments. The only specific data I could obtain was a study made by the Detroit Edison Co. several years ago, which indicated that for 3½ months in the summer production increased 51.4 percent through air conditioning, improved lighting, and soundproofing in its design departments.

After visiting several other design departments having air conditioning, I concluded that an overall increase in efficiency of approximately 20 percent for the full year could be expected. On this basis I recommended that through such improvements we could expect a minimum of 10 percent increase in production.

Our air conditioning was installed partially in 1952 and the balance last summer. Unfortunately, we have no means of direct measurement; however, discussions with the draftsmen bring out estimates of increase in efficiency during the summer months (which are quite hot in Virginia) from 20 to 100 percent. Most of the men indicate 30 to 50 percent increase. However, these estimates were made during the hot weather when the psychological effect of the advantage of air conditioning was at its height. We are particularly impressed with the improvement in morale, the reduction in controversies and irritations between draftsmen. Also, the great reduction in dirt has helped improve the work produced. — L. B. PETERSON, Assistant to Executive Vice President, Newport News Shipbuilding and Dry Dock Co.

S. M. MINER —

"This Question a Controversial One"

THE QUESTION OF how much does air conditioning boost office efficiency has been the cause of controversial statements ever since air conditioning has been applied in office space. Specific cases have been presented in an attempt to give some information, but in almost all cases the generalized statements and results are of more value than any statistical figures. The "controls" and gages of performance for this question are too difficult to permit of highly accurate statistical results.

A survey was made some years ago by an impartial business research organization to analyze the reactions of users to air conditioning. Following are some of the comments and information picked from that survey:

To the question "Do you find that air conditioning increases the efficiency of your employees" 91.3 percent of the office building employers answered "yes", 8.7 percent answered "don't know", and 93.3 percent of the bank employers answered "yes" and 6.7 percent answered "no". Seventy-eight percent of the office building management reported that increased work was done by employees in air conditioned space, 43.5 percent reported reduced errors and 21.7 percent reported reduced absences and tardiness. For bank managers, the percentages were 66.7, 73.3 and 46.7, respectively.

One office building manager reported that various tenants indicated efficiency increases on the part of employees ranging from 10 to 100 percent. As a side line, there was one comment that air conditioning tended to bring employees back to work after lunch hours quicker on the hotter days.

In surveying the employees themselves, one of the questions that was asked was "If you changed positions would you prefer an air conditioned place". Almost 90 percent of all replies were in the definitely affirmative group.

The writer discussed the subject of worker efficiency in an article on Why Precision Manufacturing Plants Are Air Conditioned in the July 1952 HPAC. There were several specific quotations and references in that article.

The Detroit Edison Co. made an efficiency survey of a drafting room operation several years ago. Before air conditioning, 8938 new work units required 5008 man-hours. Following air conditioning, 10,474 work units required only 3872 man hours,

an apparent increase in efficiency of 51.4 percent. This study was summarized by Paul G. Heidman in the October 1939 HPAC. — S. M. MINER, Consumer Sales Manager, Westerlin & Campbell Co.

W. B. HARRIS —

Maximum Concentrations of Beryllium in Air

• *A READER OF HPAC has asked for advice on ventilation facilities for a plant engaged in beryllium operations. The following suggestions were prepared in answer to his question.*

THE MAXIMUM permissible concentration of beryllium materials in the air is best defined by the following recommendations of the General Manager of the U. S. Atomic Energy Commission.

"1) The in-plant atmospheric concentration of beryllium at beryllium operations should not exceed 2 micrograms (0.000002 grams) per cubic meter as an average concentration throughout an 8 hr day.

"2) Even though the daily average might be within the limits of recommendation 1, no personnel should be exposed to a concentration greater than 25 micrograms per cubic meter for any period of time, however short.

"3) In the neighborhood of an AEC plant handling beryllium compounds, the average monthly concentration at the breathing zone level should not exceed 0.01 microgram per cubic meter.

"4) There should be an adequate medical program, supervised by a physician who is familiar with beryllium poisoning, to cover all workers exposed to beryllium and its compounds.

"5) If there is any evidence that an individual has chronic beryllium poisoning, such an individual should be excluded from any further exposure to beryllium compounds.

"6) Beryllium operations should be carried on in as few places as possible.

"7) Beryllium and beryllium compounds should not be used by uninstructed or unsupervised groups in any operation that will produce atmospheric contamination (dusts, fumes, mists, etc.)"

As can be seen from the above, the concentration of 0.001 gram per cubic meter of air mentioned in the reader's question is much higher than should be permitted. It has been our experience that concentrations even as little as 1/10 of this amount are sufficient to cause immediate illness and possibly death. This would indicate that very careful exhaust ventilation control and engineering control of all beryllium handling operations is essential to the safe processing of this material. Our experience has shown, however, that with conventional ventilation it is possible to handle large quantities of pure beryllium materials with complete safety.

Item 3, which pertains to the concentration of atmospheric pollution, requires a quite different order of control. The required concentration of 0.01 microgram per cubic meter in the outside air is a very stringent requirement. This can be attained with conventional air cleaning devices but only if all gaseous effluents entering the atmosphere are first treated. It has been our experience that any good cloth filter which is adequately maintained is quite satisfactory for this service. Electrostatic precipitation designed specifically for high efficiency operation (greater than 99.9 percent) may be satisfactorily used where cloth presents problems. In certain cases where the beryllium material is water-soluble, wet collectors of efficient conventional design are preferable.

The most satisfactory filter that we have found for general service in an application of this type is one using wool-felt as a filtration medium and reverse jet cleaning. — W. B. HARRIS, Chief, Industrial Hygiene Branch, Health and Safety Div., New York Operations Office, U.S. Atomic Energy Commission.

READER ASKS —

How Should We Protect Against Freeze-Ups of Air Conditioning Coils?

"I believe there are several different methods for protecting against freeze-ups in chilled water circulating systems for air conditioning large buildings. The problem is of particular interest to us right now, as we recently spent $4500 to replace a damaged coil in one of our buildings.

"It would be very helpful to me — and, I am sure, to other of HPAC's readers — to know more about the different ways of preventing or guarding against such freeze-ups. If the advantages and disadvantages of the various schemes could be summarized, it would aid us in deciding what to do in our buildings."—J.W.

[You are invited to comment on this question, giving actual examples if possible. Address the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2].

Reproduces Atmosphere of Prehistoric Times

THE IDEA THAT the organic compounds that serve as the basis of life were formed when the earth had a reducing atmosphere (methane, ammonia, water and hydrogen) instead of an oxidizing atmosphere (carbon dioxide, nitrogen, oxygen and water) is being studied by Stanley L. Miller, graduate student at the University of Chicago.

The idea comes mainly from considerations of the abundance of the elements in the universe and processes in which these elements can be fractionated during the formation of the earth.

His experimental apparatus can duplicate the atmosphere as it was believed to be some 3 billion years ago, and has synthesized amino acids — which, according to speculation, may have combined to form life.

49 Heat Pump Units Serve New Motel

THE "LARGEST SINGLE installation of heat pumps on record" will be made in a luxury motel in Miami Beach, according to the General Electric Co. A multiple installation of 49 units will provide all-electric year 'round air conditioning in the Belmont Park motel.

The motel consists of 22 one story buildings, each with 10 living units and all completely air conditioned. It includes four administration buildings, a restaurant and lounge.

The heat pumps are being installed by Mechanical Contractors Supply, Inc., Winter Park, Fla. An important factor in the decision to install the units in multiple was the flexibility of installation and operation. In the latter case, the machine is in operation only when the rooms it is serving are occupied.

SAM LEWIS' PAGE

Early Railway Car Heating Aided Today's Progress

SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems.

BEING DISSATISFIED with the improperly heated railway passenger coaches of 100 years ago Henry Ruttan, a Canadian, devised an improved method for distributing the heat generated from the wood burning stove. Prior to Ruttan, the stove was usually near one end of the coach, and the people near the stove could get warm, but the people at the other end of the coach had to suffer. Mr. Ruttan developed a floor construction for the coach through which the cool air could circulate back to an encasement around the stove and after being warmed, would recirculate throughout the car. I have time-faded letters to Mr. Ruttan implying that the writers would postpone their planned journey until they could be assured that such a Ruttan-heated coach would be in the train.

Ruttan extended the idea of this thermally-induced air circulation to the heating and ventilating of school rooms. The air, warmed by a big central furnace that served several rooms, entered the classroom through a large single grille on an inner wall, close to the floor. The air was returned for recirculation through many small openings at the floor along the outer walls of the room. The returning air passed between the wood joists and between secondary joists 4 in. high, transverse to the primary joists. Thus the air could pass under the entire floor to be collected into a central duct leading to the encasement around the furnace.

Ventilation Added

Eventually Mr. Ruttan's successors were inspired to arrange for ventilation — meaning a positive air change in each room accomplished by replacing with outdoor air, the air that had become odorous due to human contact. This ventilation was accomplished in hundreds of school buildings by enormous masonry chimneys, each with a furnace at its bottom to warm the chimney and induce its draft. The return air ducts from the classrooms were connected to the bases of the chimneys and with this arrangement an air change which approximated that now provided in modern mechanically ventilated schools was made possible.

Until a few school buildings caught fire, this method of heating and ventilating was very popular. However, if a fire ever started in a classroom, the tall chimney would pull the hot gases and embers through the wood joist spaces and the fire could burn the joists out with little evidence to anyone, either inside the building or outdoors. For this reason building codes now prohibit the use of combustible ducts for ventilating purposes.

The method delivered air to each room through one supply opening and removed it through several openings at the floor. The supply opening was close to the floor on an inside wall. There was always an adjustable metal deflecting screen mounted on the floor near the outlet to protect the people close to the outlet from the air being admitted into the room. It was believed that the entering air had to be much warmer than the air already in the room. It was felt necessary to heat all of the air in the room.

Return Location Unimportant

In that day, no one dreamed of introducing air that had been refrigerated so as to cool the room. When cooling with refrigerated air became available, a general corollary developed — which stated that if the supply openings are so located that the cool air being admitted into the rooms covers all the areas, the location of the return air openings is relatively unimportant. This principle is the reverse of Ruttan's idea that the cool air outlets must be distributed evenly, regardless of their location. Necessity of delivering the cool air positively to the hot spot, has been demonstrated in many air cooled theaters and manufacturing process rooms. Likewise, in heating, it has now been proven that if the supply openings are located along exterior walls so as to combat the cool air dropping off the windows and walls, the location of the return air openings is relatively unimportant.

This method of heat distribution and return air collection, which provides better results, is the reverse of Ruttan's method. However, undoubtedly Ruttan's dissatisfaction in railway coach heating many years ago was part of the beginning of the march of progress in advancing heating, ventilating and air conditioning as we know it today.

DATA SHEET

Weather Bureau Issues New Degree Day Normals

THESE NEW NORMAL degree day figures are based on U. S. Weather Bureau records for the 30 year period 1921 to 1950, inclusive.

Where a weather station had a record for the entire 30 years from the same instrument site, temperature normals are the mean of the monthly values for the 30 years. Normal maximum and normal minimum values were used to obtain monthly normals. The annual normal temperature is obtained by dividing the sum of the *annual* normal maximum value and the *annual* normal minimum value for temperature by two.

For stations that did not have continuous records from the same instrument site for the entire 30 years, 1921-1950, the means were adjusted to the record at the present site. In these adjustments, a "difference factor" was used for temperature. This factor was determined by parallel comparison, either between records at the actual station sites or through a second station that had a continuous record to compare against both sites for obtaining the resultant adjusting factors. Normals were thereafter obtained as outlined above.

These normals are derived from the values for the monthly normal maximum and minimum temperatures, and are computed on the standard base of 65 F. The seasonal total is equivalent to the annual total.

The system of normals departs from those previously used. The 30 year period (1921-1950) adopted for the computations is consistent with the term of years accepted by the World Meteorological Organization for climatic normals. Also, painstaking effort has been made to secure values that avoid artificial smoothing of the curves of monthly and seasonal march of the data; where the station and exposure for records in a given locality have been changed, the whole record has been carefully studied and adjusted to the latest source of records and reports.

"AP" after the city name indicates "airport station"; "CO" indicates "city office station".

NEW NORMAL DEGREE DAY figures, monthly and seasonal
AP indicates airport station, CO city office station

Station	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual
ALABAMA													
Anniston AP	614	485	381	128	25	0	0	0	17	118	438	614	2820
Birmingham AP	625	491	378	128	30	0	0	0	15	123	396	598	2780
Mobile AP	416	304	222	47	0	0	0	0	0	28	219	376	1612
Mobile CO	412	290	209	40	0	0	0	0	0	25	198	357	1529
Montgomery AP	517	388	288	80	0	0	0	0	0	69	304	491	2137
Montgomery CO	483	360	265	66	0	0	0	0	0	55	267	458	1954
ARIZONA													
Flagstaff AP	1231	1014	949	687	465	212	49	78	245	586	876	1135	7525
Phoenix AP	474	309	196	74	0	0	0	0	0	22	223	400	1698
Phoenix CO	425	275	175	62	0	0	0	0	0	15	182	360	1492
Prescott AP	921	717	626	368	164	17	0	0	34	261	582	843	4533
Tuscon AP	474	330	239	84	0	0	0	0	0	24	222	403	1776
Winslow AP	1001	706	605	335	144	8	0	0	20	274	665	946	4702
Yuma AP	318	167	88	14	0	0	0	0	0	0	105	259	951
ARKANSAS													
Fort Smith AP	775	571	418	127	24	0	0	0	9	131	435	698	5188
Little Rock AP	719	543	401	122	18	0	0	0	10	110	405	654	2982
Texarkana AP	600	441	324	84	0	0	0	0	0	69	317	527	2362
CALIFORNIA													
Bakersfield AP	561	750	259	105	21	0	0	0	0	41	275	505	2115
Beaumont CO	574	473	437	286	146	18	0	0	18	103	298	487	2840
Bishop AP	840	664	546	319	140	38	0	0	55	253	564	803	4222
Blue Canyon AP	893	809	815	597	397	202	36	41	105	369	635	822	5719
Burbank AP	396	308	265	152	85	22	0	0	11	59	186	324	1808
Eureka CO	552	465	493	432	375	282	267	248	264	335	411	508	4632
Fresno AP	629	400	304	145	45	0	0	0	0	86	345	580	2532
Los Angeles AP	378	305	273	185	121	56	31	22	56	87	200	301	2015
Los Angeles CO	328	244	212	129	68	19	0	0	17	41	140	253	1451
Mount Shasta CO	998	787	722	549	357	174	37	46	165	434	705	939	5913
Oakland AP	552	400	360	282	212	119	84	77	76	157	336	508	3163
Red Bluff AP	617	423	336	177	51	0	0	0	0	59	319	564	2546

NEW NORMAL DEGREE DAY figures, monthly and seasonal

AP indicates airport station, CO city office station

Station	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual
CALIFORNIA *(Continued)*													
Sacramento AP	642	428	348	222	105	7	0	0	22	98	357	595	2822
Sacramento CO	614	405	317	196	85	5	0	0	17	75	321	567	2600
Sandberg CO	781	678	629	435	261	56	0	0	26	211	465	701	4245
San Diego AP	317	247	225	151	97	43	11	7	24	52	147	255	1574
San Francisco AP	550	398	378	327	264	164	144	136	161	174	318	487	3421
San Francisco CO	462	336	317	279	248	180	189	177	110	128	237	406	3069
San Jose City Coop. Stn.	487	342	308	229	157	46	7	11	26	97	270	450	2410
Santa Catalina AP	575	328	344	264	205	121	21	11	24	77	168	311	2249
Santa Maria AP	453	370	341	276	229	152	98	94	111	157	262	391	2934
COLORADO													
Alamosa AP	1491	1176	1029	699	440	203	64	121	309	648	1065	1414	8659
Colorado Springs AP	1122	930	874	555	307	75	8	21	124	422	777	1039	6254
Denver AP	1125	924	843	525	286	65	5	11	120	425	771	1032	6132
Denver CO	1042	854	797	492	266	60	0	5	103	385	711	958	5675
Grand Junction AP	1271	924	738	402	145	23	0	0	56	333	792	1132	5796
Pueblo AP	1104	865	775	456	203	27	0	0	74	383	771	1051	5709
CONNECTICUT													
Bridgeport AP	1110	1008	871	561	249	38	0	0	66	334	645	1014	5896
Hartford AP	1178	1050	871	528	201	31	0	14	101	384	699	1082	6139
New Haven AP	1113	1005	865	567	261	52	0	18	93	363	663	1026	6026
DELAWARE													
Wilmington AP	983	876	698	396	110	6	0	0	47	282	585	927	4910
DISTRICT OF COLUMBIA													
Washington AP	893	781	619	323	87	0	0	0	37	237	519	837	4333
Washington CO	884	770	606	314	80	0	0	0	32	231	510	831	4258
Silver Hill Obs.	918	798	632	347	107	0	0	0	53	270	549	865	4539
FLORIDA													
Apalachicola CO	352	263	184	33	0	0	0	0	0	17	154	304	1307
Daytona Beach AP	245	187	137	11	0	0	0	0	0	0	83	205	868
Fort Meyers AP	124	95	60	0	0	0	0	0	0	0	25	101	405
Jacksonville AP	331	247	169	23	0	0	0	0	0	16	148	309	1243
Jacksonville CO	303	226	154	14	0	0	0	0	0	11	129	276	1113
Key West AP	34	25	8	0	0	0	0	0	0	0	0	22	89
Key West CO	28	24	7	0	0	0	0	0	0	0	0	18	77
Lakeland CO	185	142	95	0	0	0	0	0	0	0	60	167	649
Melbourne AP	169	121	76	0	0	0	0	0	0	0	44	127	537
Miami AP	58	48	12	0	0	0	0	0	0	0	8	52	178
Miami CO	57	48	15	0	0	0	0	0	0	0	5	48	173
Miami Beach Coop.	43	34	9	0	0	0	0	0	0	0	0	37	123
Orlando AP	188	148	92	0	0	0	0	0	0	0	61	161	650
Pensacola CO	383	275	203	45	0	0	0	0	0	18	177	334	1435
Tallahassee AP	385	287	203	38	0	0	0	0	0	31	209	366	1519
Tampa AP	201	148	102	0	0	0	0	0	0	0	60	163	674
West Palm Beach AP	85	61	33	0	0	0	0	0	0	0	7	62	248
GEORGIA													
Albany AP	446	333	236	40	0	0	0	0	0	39	242	427	1763
Athens AP	629	515	404	128	15	0	0	0	5	100	390	614	2800
Atlanta AP	632	512	404	133	20	0	0	0	8	110	393	614	2826
Atlanta CO	632	515	392	135	24	0	0	0	8	107	387	611	2811
Augusta AP	521	412	308	62	0	0	0	0	0	59	282	494	2138
Columbus AP	563	457	348	97	0	0	0	0	0	78	326	547	2396
Macon AP	497	391	275	62	0	0	0	0	0	63	280	481	2049
Rome AP	700	560	436	159	27	0	0	0	8	140	435	673	3138
Savannah AP	424	330	238	43	0	0	0	0	0	38	225	412	1710
Valdosta AP	486	290	210	58	0	0	0	0	0	32	203	366	1525
IDAHO													
Boise AP	1169	868	719	453	249	92	0	0	135	389	762	1054	5890
Lewiston AP	1060	815	663	408	222	68	0	0	133	406	747	961	5483
Pocatello AP	1533	1022	880	561	317	136	0	0	183	487	873	1184	6976
Salmon	1513	1103	905	561	334	169	22	55	292	592	996	1380	7922
ILLINOIS													
Cairo CO	856	683	523	182	47	0	0	0	28	161	492	784	3756
Chicago AP	1243	1053	868	507	229	58	0	0	90	350	765	1147	6310
Joliet AP	1277	1084	893	519	233	64	0	16	114	390	798	1190	6578
Moline AP	1296	1075	862	453	199	45	0	8	96	363	786	1181	6364
Peoria AP	1240	1028	828	435	192	41	0	11	86	339	759	1128	6087
Springfield AP	1166	958	769	404	171	32	0	6	83	315	723	1066	5693
Springfield CO	1116	907	713	350	127	14	0	0	56	259	666	1017	5225

This tabulation will be continued next month.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL SECTION

Costs of Operating the Heat Pump in the Equitable Building

By J. Donald Kroeker* and Ray C. Chewning**, Portland, Ore.

SUMMARY — Two previous papers on the heat pump in the Equitable Building have reported design and operating results, respectively. This third paper reports on operating costs for one calendar year. Energy costs per square foot of net rentable area developed as 0.52 cents for heating and 3.85 cents for cooling. Total costs, including salaries and other chargeable items, also per square foot, were 2.2 cents for heating, 9.1 cents for cooling, or a total of 11.3 cents.

Comparisons of energy costs for the building are also made with normal sources of energy available in Portland and with rates in other cities. Heating with district steam would have cost 6.38 and with oil 4.44 times as much as experienced with the heat pump in the year studied.

THE PERFORMANCE of the heat pump installation for year 'round air conditioning of the Equitable Building in Portland, Ore., has been observed for a period of one year. This paper discusses the results obtained with reference to energy costs for heating and cooling, and costs of maintenance, repair and operation.

Derivation of the cost of operation, segregated with regard to heating and cooling, of a heat pump system controlled automatically and providing heating and cooling simultaneously is complex and requires analysis and understanding of a large number of factors; namely, (1) the building; (2) use as affecting design, costs, and operation; (3) the heat pump system; (4) basic differences between a heat pump and a conventional system as affecting costs; (5) heating and cooling load distribution.

Further considerations in providing a paper of usefulness require inclusion of comparisons of operating costs with those of conventional separate systems for heating and cooling, conversion of final cost figures to rate schedules in other cities, and recommendations for consideration of heat pumps to larger buildings, as may be deduced from the papers and experience on the Equitable Building heat pump.

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[1]Exponent numerals refer to References.
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The Building Described

While a general description of the building, its air conditioning system, and its heat pump are included herein, as necessary in discussion of costs, a more adequate understanding thereof will be attained by review of the previous papers. The first paper[1] described the system and considerations in selection of the design used in the system. The second[2] reported operating experience, heat balances, and thermal efficiencies found effective in one year's operation of the system. It had been planned to include cost data in the second paper, but accurate costs could not be determined at that time, because suitable recording electrical demand meters, necessary to determine increments of demand chargeable to heat pump operation, were not available for installation.

A 12-story office building with a basement and two penthouse levels, the building, Fig. 1, rises 200 ft above the street, is 200 x 100 ft in area at the street level and 62 x 200 ft at the third floor level and above. It has a floor space of 212,000 sq ft (of which 148,711 sq ft is rentable space) and a volume of 2,275,000 cu

ft. Architecturally, it includes many innovations. It is the first all-aluminum-clad office building in the United States. The windows are double glazed, extend from column to column, and are flush with the building face throughout. The external panes of the windows are of heat-absorbing type glass.

Use Affects Design and Cost

The Equitable Building is a rental office building throughout. This had a bearing on system selection. Since each square foot of rentable space is revenue-producing, mechanical rooms on floors were eliminated. Since rental buildings may be subject to space rearrangement at any time, an all-air system was designed to eliminate the need for subsequent rearrangement of mechanical features and to provide means of effecting conservation and use of heat which would normally not be recoverable,[1,2] as well as being required for cooling. Provision for any desirable space rearrangement required was obtained by zoning by exposures[1] rather than by rooms.

The habits of the occupants have a material effect on costs. The building is in use from 8 a.m. until 10 p.m., hence the time of operation is longer than usual. The building's electrical demand, exclusive of the heat pumps, has peaks at approximately 11 a.m., 1 p.m., and 4 p.m. The first and third peaks are due to capacity elevator operation accommodating occupants in their indulgence of the American coffee habit. If heat pump peaks during these periods can be avoided, consequent demands chargeable to the operation of the heat pump are reduced.

Air Conditioning System

The building is completely air conditioned. A simplified diagram of the system is shown in Fig. 2. The heat pump which furnishes the heating and cooling is composed of four diffusion-type centrifugal, water-chilling machines, Fig. 3. Well water is the heat source. Wells not being pumped are used for disposal.

Referring to Fig. 2, the system consists generally of the following:

1. Twelve air conditioning units, comprised of fans and heating and cooling coils delivering air to plenums, from which air is mixed at the command of room thermostats in several zones per floor.
2. A recovery coil in the exhaust air.
3. Two preconditioning coils, each to supply ventilation air to several conditioning units.
4. Four heat pumps.
5. Other pumps illustrated.
6. A settling tank, to collect sand, if any, from well water.
7. Two warm wells and pumps, used for disposal during cooling.
8. One cool well and pump, used for disposal when heating is greater than cooling.

During periods when heating is greater than cooling the following operation is generally applicable:

1. The warm water supply and return system is a closed circuit in which water is circulated by the heating pump.
2. The warm well pump supplies well water to the settling tank pump.
3. The ST (settling tank) pump supplies water through valve W1 and the cooling pump, as required by thermostat T1, to the evaporator where heat is absorbed from it by chilling it. The heat absorbed is transferred to the refrigerant and becomes available for heating (see preceding section, paragraph 1).
4. Chilled water is supplied to the several cooling coils.
5. The discharge from the cooling coils passes through a recovery coil, absorbing heat from exhaust air, and thence to the preconditioning coils, where incoming ventilation air is heated by this waste chilled water.
6. The chilled water is then wasted to the casing of the cool well through valve S1. The amount wasted is equal to that injected by the ST pump, the remainder being recirculated by the cooling pump.

The temperature control for air conditioning and the heat pump is somewhat more complex than ordinary.[1] Heating and cooling are both available whenever the outside temperature is below 70 F. Well water from warm wells is injected into the evaporator circuit of the heat pump units whenever the heating load is

Fig. 1—The Equitable Building

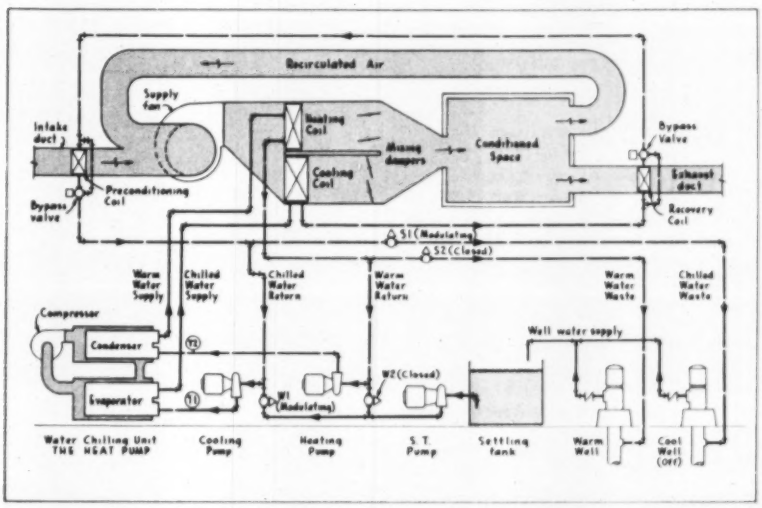

Fig. 2—Flow diagram of the heating and cooling system with valves positioned for flow when heating load is greater than cooling.

the greater and from the cool well to the condenser circuit whenever the cooling load is greater. The system is completely automatic, except that, instead of being on a clock, switching to start the system is manual. Accordingly, well water sources, operation to introduce well water, and capacity in operation are selected automatically.

Basic Heat Pump Characteristics

The significant difference between a heat pump and a conventional system, in which refrigeration is used for cooling and oil, gas, or other energy is used for heating, is the fact that, with a heat pump, heat may be obtained as a by-product anytime the system is in operation to obtain cooling. This factor, of great importance in the economical consideration of the heat pump as a heating system, was exploited in this heat pump installation.

In a building such as the Equitable Building, there are areas which require cooling even when the outside temperature drops to the design condition of 10 F. Usually, cooling loads occurring during normal heating periods are handled by the introduction of cool outside air.

In the Equitable Building this was not possible, because the space allotted to the mechanical equipment was such that it would have been impossible, without reducing the rental space for each floor, to arrange the duct work to bring in the necessary outside air and to control it to prevent drafts from air which was too cool. Further, the cost of installation would have been considerably more to provide that type of system. Thus, if instead of a heat pump a conventional system with separate heating and cooling sources had been used in *this* building, the cooling equipment would have run every day of the year.

Reference to Fig. 4, developed in studies prepared for the second paper,[2] show that the minimum cooling load in the building is in the neighborhood of 125 tons. Therefore, comparing the heat pump system with a conventional type system, it becomes apparent that the refrigeration machinery would have operated to perform a cooling function even though the heating load was considerably in excess of the cooling load. Since heating is done with the heat rejected from this cooling load, this quantity of heat is a by-product of cooling and the energy required to obtain that quantity of heat can be charged to cooling. It is shown as *By-product Heating* in Fig. 4.

Fig. 4 shows that, at an outside temperature of 50 F, the cooling load becomes greater than the heating load. Since the data from which the curve was constructed were obtained from records for cloudy weather, the changeover point, 50 F, is high. Whenever solar heat is effective, the actual outside temperature at which

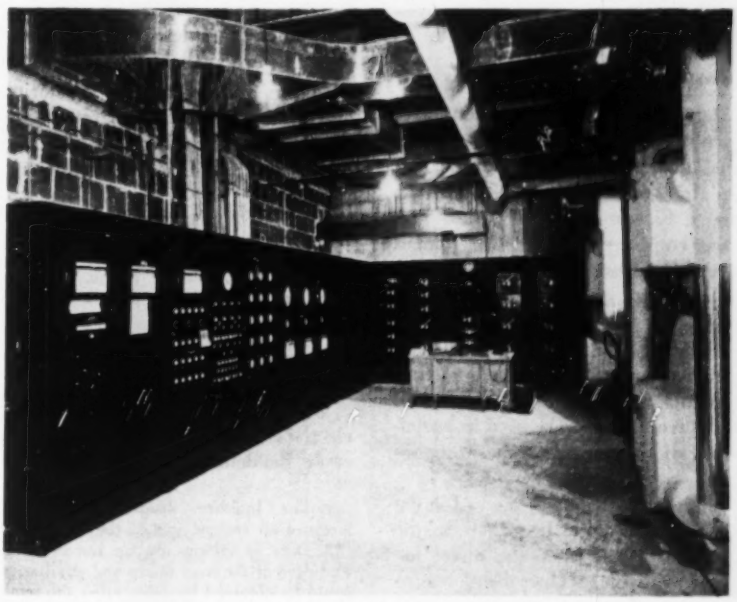

Fig. 3—Main mechanical room, showing heat pumps at right and control panels with permanent recorders and operating control at left

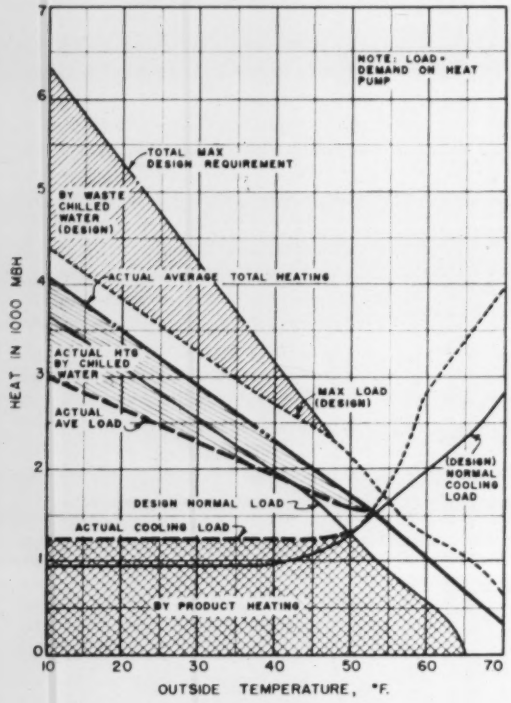

Fig. 4—Heating and cooling requirements and loads

Fig. 5—Recording electrical demand meters installed to enable cost determinations

the system changes from the condition of heating greater than cooling to cooling greater than heating is often as low as 42 F, as determined by a study of the demand meter records together with the Portland records of the U.S. Weather Bureau.

Instrumented for Cost Study

Data on the electrical characteristics of the pump and the building were obtained by the use of recording, integrating, electrical demand meters, Fig. 5, installed by the local power company on a temporary panel to enable collection of data required for this cost study. The recording meters for the mechanical system, Fig. 3, are a permanent part of the system and were installed during construction.[2] Considerable data obtained from them were used in preparation of the paper on operating results.[2]

A recording demand meter for the building was also installed in the spring of 1949, when the meter became available. Operating results had revealed the importance of building demand characteristics in determining the simultaneous critical demand occurring in operation of the heat pump. Meter troubles resulted during the following heating seasons, so that the period from April 30, 1952, to May 1, 1953, was the first for which complete and unbroken records were available.

The separate recorders, registering maximum 30-min integrated demands, were installed for the heat pumps and auxiliaries as follows:

a. Water chiller, the heat pumps.
b. Settling tank pumps. (*ST pump* in Fig. 2).
c. Heating circulating pumps.
d. Cooling circulating pumps.
e. Warm well pump.
f. Cool well pump.
g. Building master meter.

With these meters the following electrical demands and consumptions could be determined:

1. The building master meter could measure all energy used in the building.
2. Data on energy use for the building, exclusive of the heat pump and auxiliaries, could be obtained by subtracting the totals obtained from recorders *a* to *f*, inclusive, from readings of the building master meter.
3. Energy used by the heat pumps, settling tank pumps, heating and cooling circulating pumps and the warm and cool deep well pumps could be read directly.
4. Since the heating load is the greater when the warm well pump operates and cooling is the greater when no well water is used and when the cool well pump runs, periods chargeable to heating and to cooling could be determined from records of meters *e* and *f*.

The energy required for the fans in the several conditioning units could not be measured separately, because the wiring as installed makes segregation impractical. It is included in the general building energy figures.

Methods of Analysis

The kilowatt and kilowatt-hour data for the building and the system were obtained from the demand meter charts after mounting them on a device specially-constructed to permit simultaneous examination of all seven meter records for any given month, Fig. 6. Hour-by-hour data were thus studied on a total of 670 ft of electric demand charts to obtain both electrical demands and energy use for the building and each group of equipment listed by the meters above.

Maximum monthly electrical demands were found by inspection. A check was then made to determine

P.S.—4

Fig. 6—Electrical demand charts being analyzed by groups of seven

whether heating or cooling was the greater when the maximum demand for the month was established. This was done by inspection of the cool and warm well records.

If it was found that cooling was greater when the maximum combined demand was set for the month, the breakdown was made as shown for June in the first half of Fig. 7; namely,

1. The maximum combined demand was recorded for the month at 2:30 p.m. on June 26 and consisted of building demand and demand of equipment to provide cooling.
2. The combined demand at a time when the demand for the building only was maximum was recorded at 3:30 p.m. on June 27.
3. The next bar in the graph shows the portion of the maximum combined demand for the month chargeable to cooling; namely, the difference between the maximum combined demand for the month and the maximum demand for the building only.

This procedure was used because cooling should be charged with only that portion of the maximum combined demand for the month which is in excess of the demand which would have been established if there were no cooling in the building.

If it was found that heating was the greater when the combined demand was maximum for the month, the breakdown was as shown for January in the second half of Fig. 7; namely,

1. The maximum combined demand was recorded at 11:00 a.m. on January 26.
2. The maximum combined demand occurring when cooling was greater than heating was recorded at 2:30 p.m. on January 12.
3. The maximum demand for the building was recorded at 10:30 a.m. on January 15.
4. The last bar in the graph shows the distribution of demands to heating, to cooling, and to the building alone. The difference between the maximum combined demand when cooling was the greater and the maximum for the building alone, was charged to cooling. The difference between the maximum combined demand for the month and the maximum demand when cooling was the greater was charged to heating.

This procedure was used because the first requirement for consideration of the use of a heat pump is the decision to include cooling in the building design. The purpose of determining operating costs for the heat pump is to aid in the decision to use either the heat pump or a conventional cooling system with conventional heating for building air conditioning. The heat pump, then, should be charged only with that portion of the maximum demand for the month which is in excess of the demand which would be established by the conventional cooling system. The demand established by a heat pump when the cooling is greater than the heating is the same as would be established by a conventional cooling system. Again, the cooling demand should be only that portion of the maximum demand established when cooling is greater than heating which is in excess of the maximum demand which would have been established by the building if the building had no cooling system.

The determination of energy consumption was less complex, although much more laborious. The data were obtained by planimeter traverses of the recording demand meter charts of each of the meters previously listed.

Analyses Discussed

The analyses resulted in reams of tabulations, particularly in study of the march of daily demands, con-

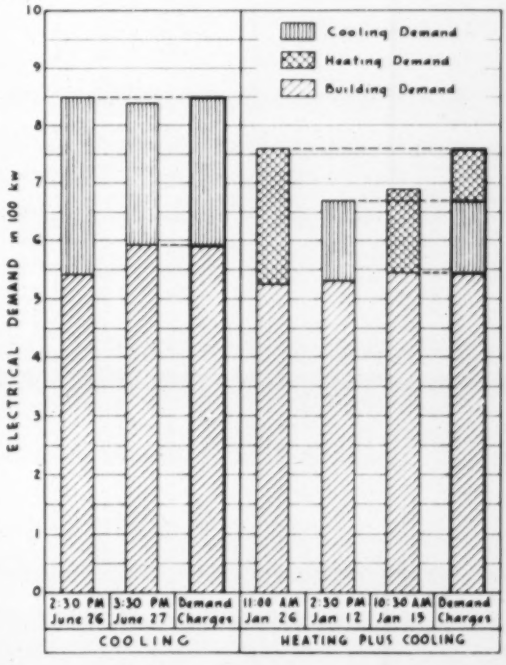

Fig. 7—Breakdown of demands chargeable to heating, cooling, and building only

verted by half-hours to consumption of electrical energy. These analyses are represented for three selected days in Fig. 8. The chart indicates demands established by the end of each hour shown. Hourly periods rather than the 30-min periods recorded and computed are shown for simplification.

The building demand shown includes the demand of the fans in the several air conditioning units, as discussed in a following section Total Air Conditioning Cost.

The demand for heat pump operation when the heating load is greatest includes about 125 tons of cooling. As the heat pump demand increases due to a load greater than that required for heating, as determined by the source of well water, the energy becomes chargeable to cooling. This is illustrated in Fig. 8 by changes between 9 a.m. and 10 a.m. of November 13. Heating during subsequent hours is the by-product of cooling.

The circulating pump load for heating and cooling, a load with minor variation, is chargeable to the type of service in effect, whether heating or cooling, and is not segregated in this chart. The same is true of the well water pumps, including deep well pumps and the settling tank pump, shown as ST pump in Fig. 2.

Table 1—Analysis of Electrical Demands and Energy Use

Month	Htg Deg Days	Operation: Time (Hrs.) Htg	Time (Hrs.) Man[a]	Time (Hrs.) Clg	Consumption (Kwhr) Htg	Consumption (Kwhr) Man[a]	Consumption (Kwhr) Clg	By-product[b] Heating	Corrected Consumption (Kwhr) Htg	Corrected Consumption (Kwhr) Clg	Electric Demands[c] Htg	Electric Demands[c] Clg
May	198	32	—	522	4,694	—	61,321	2,880	1,814	64,201	—	282
June	122	2	—	544	328	—	74,863	180	148	75,043	—	259
July	12	—	—	429	—	—	110,512	—	—	110,512	—	367
August	8	—	—	409	—	—	106,205	—	—	106,205	—	353
September	49	—	—	362	—	—	94,981	—	—	94,981	—	350
October	126	12	—	344	1,737	—	73,435	1,080	657	74,515	—	295
November	655	170	145	121	28,025	15,354	14,783	15,300	28,077	30,083	—	200
December	654	256	152	64	36,329	15,695	6,591	23,040	28,984	29,631	90	114
January	505	190	61	118	26,753	5,044	13,134	17,100	14,697	30,234	90	107
February	544	149	231	145	25,360	24,163	18,039	13,410	36,113	31,449	60	149
March	543	124	208	229	20,343	18,617	34,467	11,160	27,800	45,627	—	203
April	394	58	126	316	9,727	11,634	47,343	5,220	16,141	52,563	—	270
Total	3808	993	923	3203	153,294	90,507	655,674	89,370	154,431	745,044	240	2949

[a]Equipment on manual heating
[b]Kwh
[c]Kw

To illustrate a day in which all energy use of the heat pump was chargeable to heating, the data for November 24, 1952 were selected. The day was overcast.

The chart illustrates a type of operation not discussed; namely, manual heating. At 6:15 p.m. of the previous day, as well as at 6:15 p.m. of the day shown, the operating engineer concluded that a cold night was in prospect and that continuous operation through the night would reduce the pick-up load on the following morning. Accordingly, he set certain equipment to run all night. This included one 70-ton heat pump, the heating and cooling pumps, fans

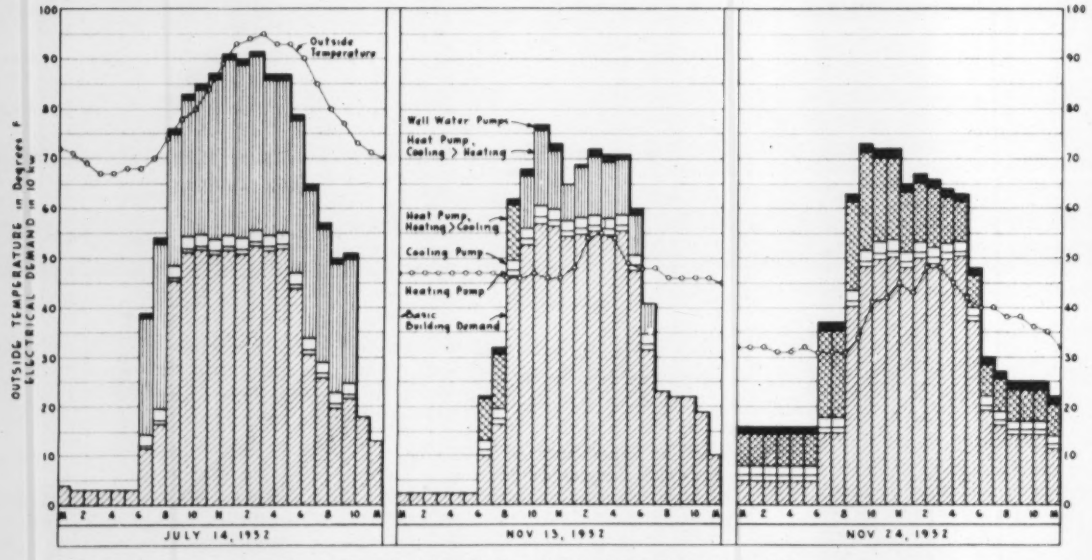

Fig. 8—March of hourly electrical loads for three selected days

Table 2—Electrical Monthly Rates
(Schedule 32, Portland General Electric Co.)

	From	To	Cost
Demand Charge	0	10 Kw	None
Dollars Per Kw	Excess above	10	$1.10
	0	150 Kwhr	Cents 3.50
	150	500	2.20
Energy Charge	500	1500	1.10
Cents Per Kwhr	1500	15,000	0.88
	15,000	40,000	0.66
	40,000	100,000	0.44
	Excess over	100,000	0.33

on alternate floors, and, automatically, the settling tank pump and the warm well pump. By doing so, he avoided a high pick up load which would have probably resulted in a high demand chargeable to heating.

Had the temperature been 15 F or 20 F, he would probably have operated a 200-ton heat pump and all fans through the night. The manual operation illustrated is used in cold weather between consecutive days and over weekends and holidays. The effect of it is to increase the energy use chargeable to heating but to avoid chargeable demands.

Data Summarized

A summary of electrical demands and energy use by months is given in Table 1. Segregation of operating time and electrical consumption to types of operation was necessary to enable determination of amounts of energy used for heating but chargeable to cooling as by-product heating, resulting in corrected values of kwhr for heating and cooling. By-product heating is considered the heat rejected during minimum cooling, Fig. 4.

The energy rejected to heating during minimum cooling was considered that effective during ideal transfer conditions; namely, a high chilled water temperature and a low condensing water temperature. In practice such conditions are not effective during applicable periods. However, they would be effective in a conventional system, in which it would be possible to do the minimum constant cooling under the ideal conditions mentioned.

Accordingly, to be comparable, the correction was made by determining the energy required by the heat pump, exclusive of auxiliaries, to produce the necessary cooling effect with a chilled water supply temperature of approximately 50 F and a leaving condensing water temperature of approximately 85 F, and multiplying this quantity by the hours of operation with heating greater than cooling.

Comparing the amount of energy used for heating with that produced as a by-product of cooling, it can be seen that, of a total heating requirement for the year of 243,801 kwhr, 89,370 kwhr or 37 percent is obtained as a by-product of cooling.

Cost Derived

The rate schedule applicable to the computation of power cost is shown in Table 2. In calculating costs, kilowatt-hours were charged at the rate of 3.3 mills per kilowatt-hour, the last block in the schedule. The demand was charged at the full rate of $1.10 per kilowatt without any deduction. This is considered proper because air conditioning, whether by conventional methods or by a heat pump, is a load added to the building after application of the general necessary electrical uses, such as lighting, elevators, and other electrical uses standard in any building, whether air conditioned or not.

A break-down of electrical costs according to type of operation, *i.e.*, heating or cooling, and according to energy use, kwhr, and demand, kw, for each month of the year from April 30, 1952, to May 1, 1953, is shown in Table 3, derived from Tables 1 and 2.

The monthly data on demands, energy use and costs are shown in Fig. 9. Energy consumption for heating, while generally following degree-days, departed from direct relationship in January and February due probably to sun effects and to more use of manual night time operation than may have been ideal for the purpose of its use. Costs paralleled demands more closely than they followed energy consumption.

The total cost due to demand charge for the year, Table 3, was $3,507.68, while the cost due to energy use is only $2,968.27. These figures demonstrate the fallacy of estimating electrical costs for heat pump systems on the basis of kwhr required to run the equipment.

The cost of energy per square foot of net rentable area, 148,711 sq ft, developed as 0.52 cents for heating and 3.85 cents for cooling, or a total for heating and cooling of 4.37 cents.

While the kilowatt demand charge forms much the larger portion of the cost of air conditioning as a whole, it is approximately 1/3 the total cost

Table 3—Analysis of Electrical Costs For Heat Pump Operation
(Cost in Dollars)

	Energy Used			Demand or Kw			Total		
	Heating	Cooling	Total	Htg	Clg	Total	Htg	Clg	Total
May '52	5.99	211.86	217.85	—	310.20	310.20	5.99	522.06	528.05
Jun.	0.49	247.64	248.13	—	284.90	284.90	0.49	532.54	533.03
Jul.	—	364.69	364.69	—	404.14	404.14	—	768.83	768.83
Aug.	—	350.48	350.48	—	388.08	388.08	—	738.56	738.56
Sep.	—	313.44	313.44	—	384.56	384.56	—	698.00	698.00
Oct.	2.17	245.90	248.07	—	324.94	324.94	2.17	570.84	573.01
Nov.	92.65	99.27	191.92	—	219.56	219.56	92.65	318.83	411.48
Dec.	95.65	97.78	193.43	99.00	125.84	224.84	194.65	223.62	418.27
Jan. '53	48.50	99.77	148.27	99.00	117.48	216.48	147.50	217.25	364.75
Feb.	119.17	103.78	222.95	66.00	164.12	230.12	185.17	267.90	453.07
Mar.	91.74	150.57	242.31	—	223.30	223.30	91.74	373.87	465.61
Apr.	53.27	173.46	226.73	—	296.56	296.56	53.27	470.02	523.29
Total	509.63	2458.64	2968.27	264.00	3243.68	3507.68	773.63	5702.32	6475.95
Total Energy cost per sq. ft. of Rentable Space (cents)							0.52	3.85	4.37

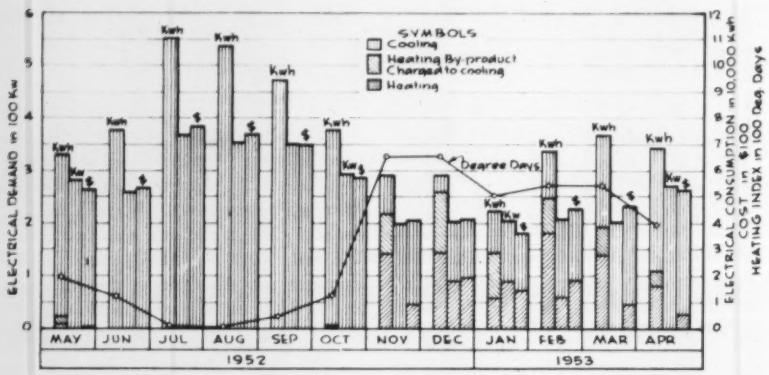

Fig. 9—Monthly energy demand and use and costs

of heating. This is due to the fact that only that amount of the heating demand charge which is in excess of the largest cooling demand charge occurring during any given month is charged to heating and is also due to the fact that the largest demands for heating energy generally occur at a time when the general building demand is very low. Heating exerts its heaviest demand during the early morning hours between 6 a.m. and 9 a.m. when the general building load is at a minimum. Conversely, the cooling demand occurs at a time when the building demand is at a peak. These factors are illustrated in Fig. 8.

Total Air Conditioning Costs

Total costs of operation of the air conditioning system include items other than those discussed so far; namely, cost of fan operation, salaries for operating personnel, cost of maintenance and repair, and the cost of water treatment. These costs, together with segregation to heating and cooling, are shown in Table 4.

The cost of energy required for operation of the fans was not included in the analysis of the cost of operation of the heat pump, because the fans were not considered a part of the basic heat pump system. However, in order to present a true picture of the complete cost of air conditioning, it was necessary to include the cost of energy supplied to the fan motors. As indicated, means of metering the power to the fans separately was not available. A good estimate of the power required for the fans was obtained by a knowledge of the types of fan operation possible and by use of the general building demand recorder.

Three types of fan operation are possible:

1. Operation with all outside air intake and exhaust fans off when the building is unoccupied, for the purpose of maintaining minimum temperatures.
2. Operation with normal outside air and exhaust fans on.
3. Operation with 100 percent outside air and exhaust at temperatures of 60 F, Fig. 4, for the purpose of obtaining reduced operation of the heat pump.

The power required for the fans was determined from the general building meter by shutting off all uses of electricity in the building and reading the demand made by the fans for each type of operation. The requirements were 53 kw for operation without outside air, 67 kw for normal operation, and 83 kw for 100 percent outside air operation. Since fan power requirements are quite constant, the knowledge of the demand and hours of operation were sufficient to make an accurate estimate of electrical use and costs.

The amount shown for total salaries of operating personnel is based upon one-half the total time of a chief operating engineer and two assistants. Many duties connected with the general building and the plumbing maintenance performed by these men were estimated as leaving one-half of the salaries chargeable to air conditioning.

Maintenance and repair costs, item 5, Table 4, include cost of materials or work performed by others, who were not operating men, on bearing lubrication, valves, refrigerant replacement, record charts, pump parts, motor repair, and filter service. Approximately 25 percent of this item is involved in filter service.

The total costs of energy are segregated with regard to heating and cooling in Table 3. Several methods of segregating costs, other than energy, for heating or cooling could be justified, depending on the type of system with which comparison might be desired. The following methods are used:

1. Fan energy, item 3, Table 4 as segregated was 92.4 percent to cooling for three reasons: (1) cooling was the basic scheme, (2) cooling occurred at all times, except during manual heating, and (3) the air systems to which the fans are basic were selected primarily because cooling was a prime requirement. Fan energy was thus charged to heating for periods of manual heating.

2. Operators' salaries and cost of maintenance and repair, items 4 and 5, Table 4, could not be apportioned to heating and

Table 4—Total Costs[a] of Air Conditioning The Equitable Building
(From Apr. 30, 1952 to May 1, 1953)

Item	Description	Heating Dollars	Cooling Dollars	Total Dollars	Total Percent
1	Heating Energy	775.63	—	775.63	4.6
2	Cooling Energy	—	5,702.32	5,702.32	33.9
3	Fan Energy	161.50	1,961.64	2,123.14	12.6
4	Operators' Salaries	1,790.00[b]	5,370.00	7,160.00	42.5
5	Maintenance & Repair	136.00[b]	544.00	680.00	4.0
6	Water Treatment	400.00	—	400.00	2.4
7	Total	3,261.13	13,577.96	16,839.09	100.0
8	Total per NRA[c]	0.022	0.091	0.113	

[a]Does not include amortization of first costs.
[b]Breakdown as estimated by C. E. Graham, Chief Operating Engineer.
[c]Cost per year per square foot of Net Rentable Area.

cooling on the basis of demands or energy consumptions. Accordingly, the breakdown represents values justified by the Chief Operating Engineer.

3. Water treatment, item 6, Table 4, would have been unnecessary if water only from the cool well had been used;[1] accordingly the cost is charged to heating.

Total costs per square foot of net rentable area developed as 2.1 cents for heating and 9.2 cents for cooling, or a total of 11.3 cents for air conditioning.

Limitations of Data

The accuracy of data presented was affected by several factors beyond control.

The recorder chart multiplier for the master meter was 1000 and the reading accurate to only two significant figures. It was therefore, possible to obtain combined electrical demand values to only the nearest 10 kw.

The values for energy consumption, determined by planimeter from the charts, were not identical with metered values, although they were within a few percent of them. The margin of error occurred in variations of chart base lines and record conformations.

Heating and cooling pump loads were charged to the heat pump operation. While this is somewhat unfair, at least in comparisons with conventional systems, these loads could not be segregated with accuracy.

The amount of sun effect, having a significant bearing on loads in a building with maximum glass areas, could not be satisfactorily indexed to relate to the data. Weather Bureau designations available for downtown Portland are unsuitable for the purpose. A cirrus cloud cover, which may be designated as 10/10 sky cover, may transmit as much as 80 percent of normal solar intensities. Other conditions given as 7/10 sky cover may be 70 percent scattered clouds or 70 percent uniform cumulus cloud cover with 30 percent clear skies, variations with significant effect on air conditioning requirements. Accordingly, loads did not follow temperatures as expected. See Fig. 8.

Comparisons With Other Systems

Discussions of heat pumps and their installation, operation, and costs naturally develop into comparisons with conventional systems of air conditioning buildings. The latter include heating systems using district steam or heating plants contained in buildings, together with cooling systems. Table 5 presents such a comparison. It is based on the all-air system installed in the Equitable Building using steam from a district steam system or No. 5 fuel oil to provide hot water circulation to heating coils in the conditioning units and the preconditioning coils, instead of condenser water.

First costs of conventional systems are not estimated. The first cost of a plant using No. 5 fuel oil would include the cost of a boiler plant within the building and of a required chimney, and the annual costs would include annual value of the space required for boilers.

Annual costs are based on the heating and cooling loads developed for the Equitable Building, the local district steam rates, averaging $0.85 per 1000 lb, and No. 5 oil at $2.71 per barrel. These values are based on comparisons of energy cost only derived from average temperature data, resulting loads under overcast sky conditions from Fig. 4; and heat balance curves developed for the second paper.[2]

Using district steam, which is available and would have been used had a heat pump system not been adopted, the total cost of energy for air conditioning for the year would have been 65 percent greater. Table 5 also shows that the cost of energy for cooling was only 17 percent greater than the cost of district steam for heating only. The cost of energy for heating and cooling the Equitable Building was only 31 percent greater than the cost of district steam would have been for heating only.

Portland district steam rates are relatively low. If estimates on district steam use for the Equitable load were based on rates in other cities, instead of the average rate of $0.85 per 1000 lb, they would be developed at $1.46 for New York, $1.15 for St. Louis, $1.52 for Seattle, $1.64 for Chicago, and $1.43 for Minneapolis, the average rates given in the 1952 report of the Operating Statistics committee of the *National District Heating Association*.

Comparison With Other Cities

Electrical rates for the Pacific Northwest are generally understood as exceptionally low. Table 6 is a conversion of costs to rates of other cities considered applicable; namely, San Francisco, St. Louis, Chicago, Minneapolis, and Seattle, as published in the National Rate Book of the Federal Power Commission. The rates on demand charges in other cities are understood to be based on the maximum 15-min integrated demand occurring in a month instead of the 30-min basis used in Portland. The 30-min demands of the recorder

Table 5—Comparisons of Costs of Energy of a Heat Pump System and a Conventional System in The Equitable Building

Heating Energy	Heating Cost		Cooling Cost	Total Cost
	Dollars	%	Dollars	Dollars
The Heat Pump System	773.63	100	5,702.32	6,475.95
District Steam*	4,930.00	638	5,702.32	10,632.32
No. 5 Fuel Oil*	3,430.00	444	5,702.32	9,132.33

*With separate cooling system as installed.

Table 6—Comparisons of Costs of Energy at Electrical Rates of Other Cities

City	Schedule*	Heating Dollars	Cooling Dollars	Total Dollars	Total Percent
Portland		773.63	5,702.32	6,475.95	100
Seattle	Commercial	1,256.58	8,374.83	9,631.41	148
San Francisco	A-13	1,481.15	8,862.44	10,343.59	160
St. Louis	Large L & P	1,415.53	9,222.65	10,638.28	164
Chicago	Large Commercial	1,132.45	8,529.18	9,661.63	149
Minneapolis	Large Commercial	1,963.53	12,559.37	14,522.90	224

*From National Rate Book of the Federal Power Commission.

charts were considered as 15-min demands in computing values for Table 4. The comparisons are based on quantities developed for the Equitable Building, Table 1, without attempted conversion by degree-day ratios to these cities. Approximate conversions of heating costs by heating degree-day ratios, if made, should be considered accurate to no more than ± 15 percent.

Adaptation of a similar heat pump system or any large heat pump system to another location is attended by consideration of other physical factors requiring individual analysis not considered here. These include availability of well water, practicability of disposing to a stratum not being pumped, sewer charges if disposal to ground is impracticable, and water charges if well water is not available at reasonable cost. Use of city water as a heat source generally will rule out economic feasibility.

Summary

Methods of analysis of operating heat pumps are complex and depart widely from usual considerations. Heat pump operation cannot be evaluated in the normal manner applicable to conventional systems. Few heat pump installations will warrant equipment and costs of analyses required.

Significant cost data developed and applicable to the Equitable Building, probably exclusively, as disclosed in one year's operation are as follows:

1. Heating as a by-product of cooling represented 37 percent of total heating provided.
2. The cost of energy for the year per square foot of net rentable area totalled 0.52 cents for heating and 3.85 cents for cooling.
3. The total cost of operating the system for the year totalled 2.1 cents per square foot of rentable area for heating and 9.2 cents for cooling.
4. The cost of cooling was 17 percent greater than heating would have been if heating alone had been accomplished separately with district steam.
5. Heating with district steam would have cost 6.38 times as much as that provided with the heat pump as applied.
6. If district steam had been used, the total air conditioning cost would have been 65 percent greater.
7. While Portland electric and district steam rates are comparatively low, it appears from percentages in Table 4 and from percentages calculated from average district steam rates for several cities given in the section, Comparisons with Other Systems, that the increase in cost of steam is higher than the increase in cost of electricity. Accordingly, the use of a heat pump such as that in the Equitable Building would appear more favorable in these cities than in Portland.

The most important fact revealed in this study of costs of operation of the Equitable Building is that, while a heat pump might not be economical when installed for the purpose of heating alone, its use in conjunction with cooling can save thousands of dollars per year as compared to a conventional heating and cooling system in a building as large as the Equitable Building.

Because the heat pump finds economic application as the means of heating only when conditions are favorable and a cooling system is desired, the determination of heating cost should be made on the basis of a system performing a comparable function. Demands should be computed as discussed and illustrated in Fig. 7.

Because it produces both heating and cooling from the energy required for cooling alone, the quantity of heat produced as a by-product of cooling must be considered.

The importance of flexible automatic control, and intelligent operation are great in the maintenance of economical operation.

The greater the emphasis placed upon demand charges in the electrical rate under which the heat pump must operate, the more economical will heating with a heat pump be in an air conditioning system.

In any large heat pump installation, the permanent installation of recording demand meters will probably be economically justifiable as an aid to the operating engineer in avoiding demand peaks chargeable to heating.

Acknowledgments

Grateful acknowledgments are made to the following for assistance in obtaining the data reported herein: The Portland General Electric Co. for loan and monitoring of the recording demand meters; Messrs. Sharp, Cadigan, Wiitala, C. W. Brissenden, and A. N. Hoss of the power company for assistance with analysis; and C. E. Graham, chief operating engineer of the building, for daily monitoring of the recorders.

References

1. A Heat Pump in an Office Building, by J. Donald Kroeker and Ray C. Chewning (ASHVE TRANSACTIONS, Vol. 54, 1948, p. 221).
2. Heat Pump Results in Equitable Building, by J. Donald Kroeker, Ray C. Chewning, and Charles E. Graham (ASHVE TRANSACTIONS, Vol. 55, 1949, p. 345).

AIR POLLUTION LABORATORY OPENED IN NEW YORK

The new Laboratory of the Department of Air Pollution Control of New York City, located in the Meinhard Clinic Building, 130 East 101 Street, was opened with proper ceremonies on Wednesday, October 14, 1953, participants being Mayor Vincent R. Impellitteri, Ralph Muckenfuss, M.D. Assistant Commissioner, Department of Health, Richard A. Wolff, Professional Engineer, and Dr. C.-E. A. Winslow, Leonard Greenburg, M.D., Commissioner, Department of Air Pollution Control, presided at the meeting.

Each of the speakers stressed the scientific approach to the air pollution problem which would be made in the new Laboratory, where the staff would first determine the type, nature, and quantity of contaminants existing in the air. The sources of these contaminants would then be investigated and regulations established for the gradual reduction of the contaminants. The ceremony was attended by 125 invited guests, seven of whom were members of ASHVE and included, in addition to Drs. Greenburg and Winslow and Mr. Wolff, W. L. Fleisher, Prof. Karl F. Kayan, H. S. Birkett, and C. H. Flink, Technical Secretary.

Room Air Distribution Research For Year 'Round Air Conditioning

Part II — Supply Outlets at Three Floor Locations

By H. E. Straub* and S. F. Gilman**, Urbana, Ill.

SUMMARY — The results of the second phase of a research program concerning room air distribution for residential year 'round air conditioning are presented.

With several sizes of floor registers and floor diffusers installed singly at one of three locations in a test room, studies of the room air distribution were made over a range of flow rates under winter heating, isothermal, and summer cooling conditions of operation. It was found that floor outlets located at the center of an exposed wall provided the best air distribution during year 'round conditions of operation.

The next phase of the research program will deal with baseboard slot-type outlets and low sidewall diffusers.

AN IMPORTANT problem involved in the year 'round air conditioning of residences is the distribution of heated air in winter and cooled air in summer from the same supply outlets in such a manner that satisfactory conditions of comfort are maintained at all times. This problem has been under investigation for some time at the University of Illinois in cooperation with the *American Gas Association*. The object of the research program is to obtain engineering data for selecting the proper types and locations of supply outlets for year 'round air conditioning of residences. The facilities being used for this investigation, together with the test conditions and procedure, have been described in a previous paper[1], which also presented the results of studies conducted with supply outlets at one high sidewall location.

The present paper reports the principal results obtained during the second phase of the air distribution research program which dealt with floor registers and floor diffusers at three different locations in the test room under winter heating, isothermal, and summer cooling conditions of operation.

Description of Apparatus

Since the apparatus is discussed in detail in a recent ASHVE paper[1], only a brief description will be given here.

An isometric view of the test room is shown in Fig. 1. The room is 13¾ ft wide and 18 ft long, with an 8½ ft ceiling height. It is surrounded by an insulated structure, not shown in the figure, which forms corridors along the north and east walls of the room. Facilities are available for independently controlling the temperature in the corridors, in a basement space below the room, and in an attic space above the room over a range from − 10 F to 130 F. Approximately 70 thermocouples are located in the walls, attic, basement, and corridors. The north and east walls simulate *exposed* walls of a room, whereas the south and west walls simulate *inside* walls of a room.

The locations utilized for supply outlets are identified by Roman numerals. Location I, high in the west wall, was also used during 43 tests reported in the previous paper. Locations II, III, and V are in the floor: II is centered along the south (inside) wall; III is centered along the north (exposed) wall; and V is in the northeast corner at the junction of two exposed walls. The 5 x 28 in. baseboard return intake is located near the center of the west wall.

Each floor supply outlet was connected to the duct system in the basement space by the apparatus shown in Fig. 2. Supply air was delivered to a 14 x 14 in. outlet box and then directed upward into a liner by turning vanes. The liner had the same dimensions as the nominal size of the outlet, and was so located in the box that the outside edge of any supply outlet, regardless of its size, was 6 in. from the wall. The opening of the box not filled by the liner was capped at the floor level and sealed. Before the supply outlet was put in place, the turning vanes were adjusted to give a uniform velocity across the face of the liner. The dampers in all outlets were set for straight flow where possible; otherwise they were removed.

Fig. 3 shows a portion of the interior of the test room as viewed when looking east. The baseboard return intakes shown were not used during the studies reported in this paper. The device on wheels in the foreground is a vertical rack that can be moved to any desired position along the length of the room. The rack supports 30 heated-thermo-

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[1]Exponent numerals refer to References.

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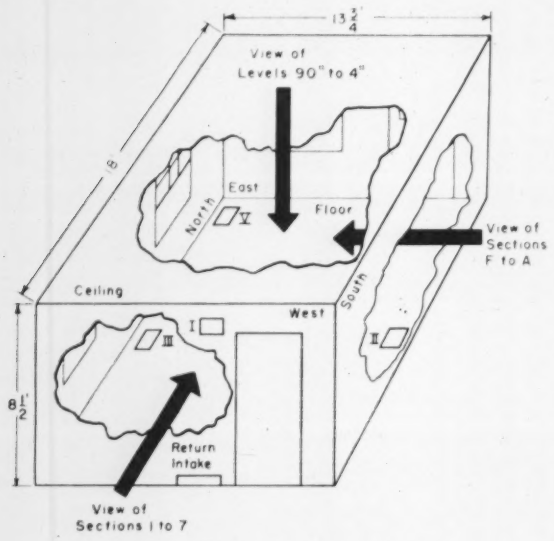

Fig. 1—Isometric view of test room

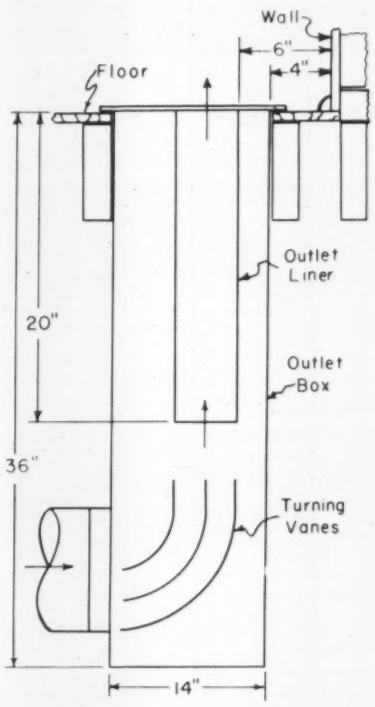

Fig. 2—Supply outlet apparatus

couple anemometers for measuring air velocities and temperatures. Rows of six are uniformly spaced 4, 30, 60, 78, and 90 in. above the floor. The average temperature as measured by the central four anemometers located 30 in. above the floor, with the rack positioned in the center of the room, was used as the control (room) temperature to be maintained at 75 F during all tests.

Test Conditions and Procedure

For the majority of the winter heating and summer cooling tests, the control (room) temperature, as well as that in the basement and in the spaces outside the south and west walls, was maintained at 75 F.

During the heating tests, the temperature in the north and east corridors was held at about −5 F, and that in the attic at about 30 F. Studies were made with flow rates of 125, 230, 310, and 420 cfm (3.6, 6.5, 9, and 12 air changes per hour). The corresponding supply air temperatures were of the order of 135, 108, 99, and 93 F respectively.

During the summer cooling tests, the temperature in the north and east corridors was adjusted until the supply-air temperature was either 60 F with a flow rate of 310 cfm or 55 F with a flow rate of 230 cfm. These combinations gave 15 deg and 20 deg temperature differentials between the control and the supply air temperature. The temperature in the attic space was maintained at about 125 F.

The sizes of the registers and diffusers were selected to provide supply air velocities, based on the outlet free area, of 300, 450, 600, and 900 fpm with the flow rates as given.

The general procedure for each test was the same as used previously[1], and consisted of velocity and temperature traverses of the room with the rack of heated-thermocouple anemometers, followed by additional explorations in the room using smoke and a portable anemometer.

Tests Conducted

The tests conducted and reported in this paper are presented in Table 1. Of the 60 tests listed, 39 were conducted under winter heating conditions, 16 under summer cooling conditions, and five were isothermal explorations. Three heating tests (No. 44-46) were conducted with high sidewall supply outlets, 20 with floor registers, and 16 with floor diffusers. Nine cooling tests were conducted with floor diffusers and seven with floor registers. The tests are listed in numerical order in column 1 beginning with Test No. 44. The 43 initial tests were conducted with high sidewall outlets and have been reported previously[1].

Column 2 gives the test designations. The letters preceding the numbers refer to the type of test and have the following meanings:

H = Heating with a heated basement.
C = Cooling.
I = Isothermal.
CS = Heating with a simulated crawl space temperature of 40 F.
SS = Heating with storm sash.

The numbers have the following meaning: the first numeral refers to the supply outlet location designated in Fig. 1 by a Roman numeral. The second numeral refers to the nominal flow rate as follows: 0 = 125 cfm; 1 = 230 cfm; 2 = 310 cfm; 3 = 420 cfm. The third numeral refers to the nominal supply air velocity as follows: 1 = 300 fpm; 2 = 450 fpm; 3 = 600 fpm; 4 = 900 fpm. The letter D following the number signifies a floor diffuser; otherwise, a floor register was used. The test designation allows a quick comparison

of test conditions. For example, Tests 67 and 68 in Table 1 are heating tests conducted under approximately the same conditions of outlet location, flow rate, and supply-air velocity, the principal variable being the type of outlet. A register was used in No. 67 and a diffuser in No. 68.

The vane settings of Column 5 are illustrated in Fig. 4. The first two settings were used for the high sidewall studies (Nos. 44-46). The vanes for Setting H have a zero deg deflection; this setting applies to all floor registers. The remaining two settings apply to floor diffusers, with J indicating settings made at the factory and K indicating special settings made by the research personnel.

The supply-air velocity, Column 8, is the flow rate of supply air divided by the outlet free area. The air changes per hour, Column 10, are the flow rates per hour of return air divided by the cubical contents of the room. The load ratio, Column 11, is the actual cooling or heating load divided by the difference between the control temperature and the north and east corridor temperature. The velocity index, Column 12, is the percentage of the total number of traverse points in the 4, 30, 60, and 78-in. levels, excluding those within about one foot of any wall surface, at which the velocity was between 15 and 35 fpm. The temperature variation, Column 13, is the difference between the average temperature at the 60-in. level and that at the 4-in. level, and for the heating tests the values are adjusted to a 0 F outdoor temperature.

Winter Heating Studies with a Heated Basement

Of the tests listed in Table 1, 33 were conducted under the conditions of winter heating with a heated basement; *i.e.*, basement space temperature of 75 F. During these studies, the *outdoor* temperature (north and east corridor temperature) was maintained at approximately −5 F.

For each test, the principal data for analysis consisted of the temperatures and velocities at 210 points in the room obtained by traverses with the 30 heated-thermocouple anemometers, together with the results of additional explorations of the jet characteristics and the general motion of the air masses within the room. Fig. 5 is representative of the general method of compiling the principal data obtained for each test. Such diagrams, combined with supplementary data, served as the basis for analyzing and interpreting the data from all tests.

The diagrams in the left column of Fig. 5 show five horizontal sections at the 90, 78, 60, 30, and 4-in. levels of the room as viewed from above (see vertical arrow in Fig. 1). Each intersection of the grid lines in the diagrams represents a point at which the velocity and temperature were measured; the upper number indicates the temperature variation from the control (room) temperature, and the lower number indicates the velocity. For example, at the 4-in. level at F-6, the temperature is 5.5 deg below the control temperature, and the velocity is 13 fpm. Where no temperature value is given, the variation is zero. The arrows show the direction of the air motion at the particular level.

The diagrams in the right column of Fig. 5 show seven vertical sections of the room. Sections designated by the numerals 1, 2, etc. lie along the correspondingly numbered lines on the diagrams in the left column (see oblique arrow in Fig. 1). Sections designated by the letters A through F (only section F is shown) lie along the correspondingly lettered lines of the diagrams in the left column (see horizontal arrow in Fig. 1).

Although a total of 13 vertical and 5 horizontal sections were used in analyzing the data, diagrams of some of the less significant sections have been omitted from this paper. When all 13 vertical sections are fixed in upright positions and the 5 horizontal sections sandwiched into these in an egg-crate manner, a three-dimensional representation of the temperature variations, velocities, and flow patterns in the room is obtained.

Fig. 5 shows the principal data for Test 57 which was conducted with a 6 in. x 12 in. diffuser in location H, a nominal flow rate of 230 cfm, and a nominal supply-air velocity of 600 fpm. From Columns 12 and 13 of Table 1 the velocity index is 83 and the temperature variation 6.6 deg.

Section F in the upper right of the figure shows that the primary air

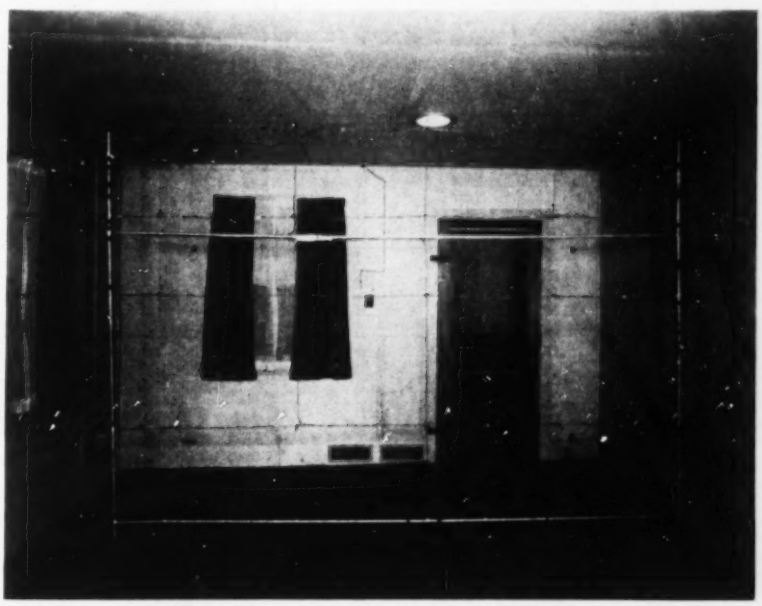

Fig. 3—View of interior of test room, looking east

splits into two main jets, with axes about 40 deg from the register centerline, and a minor jet straight up. The mixture of primary and induced air; *i.e.*, the total air, fans out and blankets the upper portion of the south wall, and then flows along the ceiling (Note 90-in. level diagram) and along the east and west walls. At the 78, 60, and 30-in. levels, two circulatory motions are set up as a partial result of the induction effect of the supply jet. At the 4-in. level, the cooler air falling off the inside surfaces of the exposed walls flows in the general direction of the warm corner near F-1, although some is drawn into the return and some is induced by the supply jet. In vertical planes, as shown in Sections 1 to 6, the general motion is up the south wall, across the ceiling, and down the north wall.

Regions in which the velocity is 15 fpm or less are enclosed by a jagged line. Within these regions a stagnation condition exists in that the air motion is hardly perceptible and smoke diffuses into a layer and remains there for some time. Since the HEATING, VENTILATING, AIR CONDITIONING GUIDE, 1953,[2] states that air velocities less than 15 fpm give people a feeling of stagnation, the air distribution within these regions is considered to be poor. Hence, the number and size of such regions provide one index of the quality of the air distribution within a space. A second index is the temperature variations within the zone of occupancy, while a third is the size of the region in which the velocities are in the desirable range of 15 to 35 fpm.

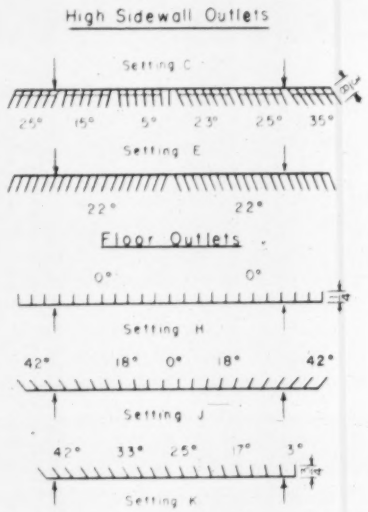

Fig. 4—Description of outlet vane settings

Fig. 6 shows four diagrams for each of two heating tests conducted under conditions nearly equivalent to those of Test No. 57 (Fig. 5) with the exception of the location and type of supply outlet.

Test 44 was conducted with a high sidewall supply outlet at Location I, and the diagram of the 90-in. level in Fig. 6 shows the two jets produced. This two-jet condition was discussed in the previous paper[1]. The flow pattern here at a level above the zone of occupancy is two circulatory motions, one clockwise and one counterclockwise. Reference to the large stagnation regions shown in the other diagrams indicates that practically all of the induction and air motion took place above the occupied zone. Such

Table 1—Studies with High Sidewall and Conventional and Diffuser Floor Supply Outlets

Test No.	Test Designation	Outlet Location	Outlet Size	Vane setting	Control Temp, F	Supply-Air Temp, F	Supply-Air Velocity, fpm	Flow Rate, cfm	Air Changes per Hour	Load Ratio, Btuh per Deg F	Velocity Index, percent	Temp. Variation 4-in. to 60-in. levels, Deg F
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
44	H113	I	14x8	E	75	102	505	254	7.3	107	59	13.3
45	H117	I	14x5	E	75	104	894	257	7.3	111	62	9.3
46	H121	I	14x8	C	75	109	524	228	6.5	118	52	15.5
47	H201	II	6x12	H	75	134	380	129	3.7	99	59	13.5
48	I201	II	6x12	H	73	73	348	133	2.6	0	74	0.0
49	H202	II	6x8	H	76	135	549	125	3.6	109	63	13.2
50	H203	II	4x10	H	75	136	707	127	3.6	112	65	13.1
51	H204	II	4x6	H	75	135	1210	127	3.6	110	68	11.2
52	I204	II	4x6	H	71	71	1040	123	3.5	0	92	0.0
53	H212	II	8x12	H	75	108	467	224	6.4	112	73	10.2
54	H213	II	6x12	H	75	107	628	224	6.4	108	74	9.5
55	C213 D	II	6x12	J	76	57	582	228	6.5	97	50	1.9
56	CS213 D	II	6x12	J	75	115	655	227	6.5	136	79	9.5
57	H213 D	II	6x12	J	76	106	645	227	6.5	99	83	6.6
58	H214	II	6x8	H	76	106	946	228	6.5	106	80	8.0
59	H223	II	8x12	H	75	97	634	310	8.9	103	85	6.8
60	C224	II	6x12	H	75	59	795	312	8.9	120	55	0.2
61	C224 D	II	6x12	J	75	60	813	313	8.9	123	81	0.0
62	H224	II	6x12	H	75	100	852	309	8.8	111	90	6.5
63	H234	II	8x12	H	75	97	852	415	11.8	113	76	7.2
64	I234	II	8x12	H	73	74	824	417	11.9	0	40	0.0
65	H301	III	6x12	H	75	134	374	127	3.6	106	64	13.7
66	H301 D	III	6x14	J	76	132	315	123	3.5	101	63	9.6
67	H303	III	4x10	H	75	132	700	126	3.6	106	64	12.8
68	H303 D	III	4x10	J	75	128	748	130	3.7	101	72	8.3
69	SS303 D	III	4x10	J	75	127	717	122	3.5	91	63	7.5
70	H304 D	III	2x14	J	75	134	861	125	3.6	103	72	7.9
71	C312 D	III	6x14	J	76	55	494	226	6.4	96	53	3.8
72	C313	III	6x12	H	76	56	576	228	6.5	109	89	0.1
73	H313	III	6x12	H	75	104	627	225	6.4	105	78	8.9

a condition was a result of the buoyancy effect of the warm supply air issuing from an outlet located above the occupied zone. The large stagnation region, together with the 13.3 deg temperature variation (Col. 13, Table 1), indicates poor air distribution.

The lower half of Fig. 6 shows four diagrams from an equivalent heating test with a conventional floor register at Location III. Referring to the Section A diagram of Test No. 73, the upward discharge of the air from the register, together with the natural buoyancy of the warm supply air, results in little spread of the jet and a relatively small amount of induction before the jet impinges on the ceiling. The stream then flows out across the ceiling (90-in. level diagram) and down the inside wall (Section 4).

Comparison of the diagrams for Tests Nos. 44 and 73 in Fig. 6 shows that the air temperature near the ceiling is lower with the floor register (Test No. 73) than with the high sidewall register (compare 90-in. level data). This results in a lower temperature variation in the occupied zone, as reference to Table 1 will show. In addition, the stagnation region is much less for Test No. 73 than for Test No. 44, although nearly all velocities in the former are less than 35 fpm and therefore not excessive. Consequently, it is concluded that the air distribution from the conventional floor register at Location III, Test No. 73, is better than that with the high sidewall register at Location I, Test No. 44, for the particular test conditions used.

Similar analyses made of comparative tests at various other outlet locations corroborated the conclusion that conventional floor registers can be expected to provide better air distribution during winter heating than high sidewall registers.

Fig. 7 presents four diagrams from a heating test under the same conditions as Test No. 73, Fig. 6, except that the outlet is a floor diffuser instead of a floor register. Comparison of the diagrams and the Table 1 data shows that with the diffuser (Fig. 7) the size of the stagnation region is considerably reduced and the temperature variation is 30 percent less. Moreover, analysis of all 13 diagrams showed a greater uniformity of velocity throughout the occupied zone. From the results of this and other tests, it was concluded that diffusers furnished better air distribution than registers during winter heating. The principal reason for this is that the wide spread of the jet issuing from a diffuser provides a large jet surface which induces considerable room air after only a short travel. This then causes rapid mixing of the warm supply air with room air and subsequent small temperature variations in the occupied zone.

It should be noted that good air distribution can be obtained with a diffuser on an inside wall as well as on an exposed wall. This can be verified by comparing Figs. 5 and 7, in which the only variable is the loca-

Table 1—Studies with High Sidewall and Conventional and Diffuser Floor Supply Outlets *(concluded)*

Test No.	Test Designation	Outlet Location	Outlet Size	Vane setting	Control Temp, F	Supply-Air Temp, F	Supply-Air Velocity, fpm	Flow Rate, cfm	Air Changes per Hour	Load Ratio, Btuh per Deg F	Velocity Index, percent	Temp. Variation 4-in. to 60-in. levels, Deg F
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
74	SS313	III	6x12	H	75	103	652	227	6.5	98	72	8.4
75	C313 D	III	6x12	J	75	55	578	227	6.5	102	67	1.4
76	CS313 D	III	6x12	J	75	113	655	227	6.5	134	85	9.0
77	H313 D	III	6x12	J	76	107	634	225	6.4	100	85	5.7
78	I313 D	III	6x12	J	74	74	610	229	6.5	0	89	0.0
79	SS313 D	III	6x12	J	76	104	639	227	6.5	91	87	5.6
80	C314	III	6x8	H	77	56	854	228	6.5	113	83	0.1
81	C314 D	III	4x12	J	75	56	882	228	6.5	116	79	0.0
82	C316 D	III	6x12*	J	76	56	710	228	6.5	120	79	0.2
83	C322	III	10x14	H	75	60	400	314	9.0	127	79	0.0
84	H323	III	8x12	H	75	98	648	312	8.9	115	80	8.8
85	C323 D	III	6x14	J	75	61	668	312	8.9	126	88	0.1
86	H323 D	III	6x14	J	75	99	746	311	8.9	108	84	5.3
87	SS323 D	III	6x14	J	76	98	737	309	8.8	96	89	4.6
88	C324	III	6x12	H	75	60	802	315	9.0	133	65	0.2
89	H324	III	6x12	H	75	98	850	310	8.8	103	84	6.3
90	C324 D	III	6x12	J	75	60	796	312	8.9	121	90	0.2
91	H324 D	III	6x12	J	75	99	869	311	8.9	104	79	4.5
92	I324 D	III	6x12	J	73	73	857	314	8.9	0	74	0.0
93	H501	V	6x12	H	75	138	575	127	3.6	115	64	13.9
94	H511	V	12x12	H	75	105	319	226	6.4	108	63	11.1
95	H513	V	6x12	H	75	105	638	229	6.5	105	79	9.7
96	H513 D	V	6x12	K	75	105	742	227	6.5	100	87	7.4
97	H515 D	V	(4x10 (2¼x14	K) K)	76	108	750	227	6.5	95	63	7.1
98	C522	V	12x12	H	75	62	402	311	8.9	114	56	1.7
99	H522	V	12x12	H	75	96	428	310	8.8	107	78	9.7
100	C524	V	6x12	H	75	60	801	314	9.0	126	34	0.2
101	C524 D	V	6x12	K	75	59	945	315	9.0	137	51	0.3
102	H524	V	6x12	H	75	99	855	312	8.9	105	71	7.9
103	H533	V	12x12	H	76	92	561	411	11.7	99	86	8.4

*Part of free area sealed off to provide 710 fpm Velocity.

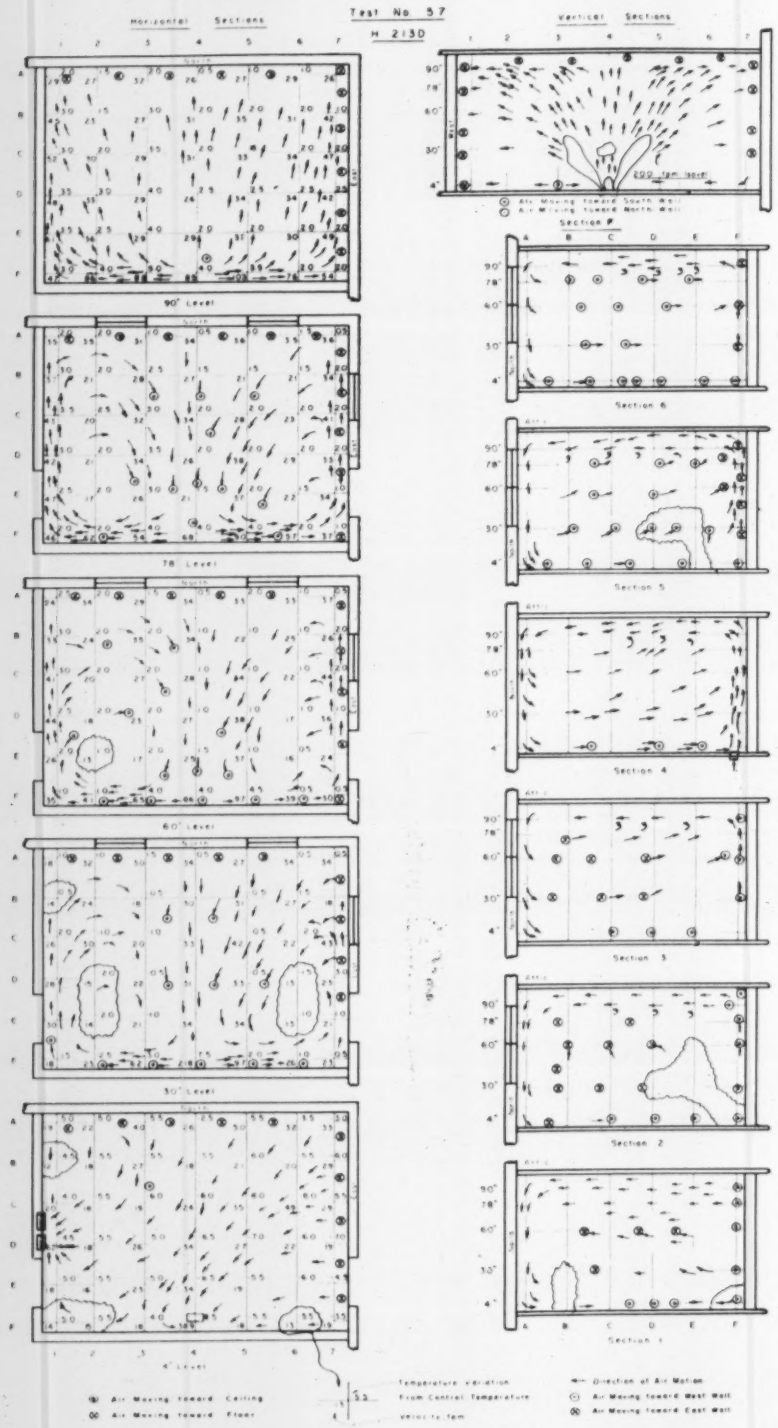

Fig. 5—Principal data of Test No. 57

tion of the diffuser. Little difference in the air distribution can be noted in the diagrams. However, detailed comparison of the test data indicated that the diffuser located along the exposed walls provided slightly better air distribution. The principal advantage of the exposed wall location for diffusers is that the issuing jet effectively counteracts the cold air falling down the walls and windows (see Sections A and 4 of Fig. 7). However, even the diffusers located along the inside wall provided much better air distribution than any of the conventional registers in any of the three floor locations shown in Fig. 1.

For a given diffuser, the results of the studies showed that the order of best-to-worse location was III, II, and V. Referring to Fig. 1, note that V is a corner location. Such locations have distinct disadvantages because the adjacent wall surfaces so confine the jet that little induction of room air is possible, the result being large temperature variations and little air motion in the occupied zone above 15 fpm. Test No. 97 was conducted in an attempt to improve the air distribution from a corner location. Two diffusers were butted together, with one facing along the east wall and the other facing along the north wall. Special vane settings were used in an effort to blanket both the east and north walls with warm air. However, little improvement in the air distribution was obtained. From this and other tests conducted at Location V, it was concluded that restricted regions such as corners are not desirable for diffusers.

For a given floor register, the results of the studies indicated that Locations II, III, and V resulted in about the same air distribution which, however, was better than that obtained with high sidewall registers at Location I. On the other hand, floor registers resulted in poorer air distribution than obtained with diffusers at Location V. In general then, the floor diffusers provided better air distribution than the floor registers, which in turn provided better air distribution than the high sidewall outlets.

During the course of conducting tests with registers or diffusers at each of the four locations, the supply-air velocity was varied by installing different sizes of outlets. Also, with a particular outlet installed, tests were conducted at from one to four rates of flow (cfm). The results of these studies showed the individual effects of supply-air velocity and flow rate on the air distribution. In general, the flow patterns illustrated in the foregoing are representative of those at other velocities and flow rates, the principal exception being the combination of the lowest velocity and smallest flow rate. For this exception, since the supply air had relatively little energy, it floated to the ceiling and spread out across it in a gentle motion. As a consequence, the room air motion was primarily a result of free convection currents along the surfaces. The usual downward motion on the oppsite wall, *e.g.*, Section 4 of Fig. 7, was therefore not nearly as pronounced as in the other tests.

These velocity and flow rate studies showed that for the better floor locations (II and III) a change in supply-air velocity had little effect on the air distribution. However, a change in flow rate, with its consequent change in the temperature of the supply air, had a relatively large effect on the air distribution, which was better at the higher flow rates. Results of the three tests with high sidewall outlets, however, indicated that either an increase in supply-air velocity or an increase in flow rate produced a significant improvement in the air distribution.

Heating With Special Test Conditions

Of the tests listed in Table 1, six were conducted under special conditions to evaluate the effect of: (1) reduced basement space temperature; and (2) storm sash on the windows.

Tests Nos. 56 and 76 were conducted with a 40 F basement space temperature to simulate an unheated crawl-space beneath a room. The results were then compared with those of equivalent tests with a heated basement, Tests Nos. 57 and 77. For the crawl-space condition, the temperature variations between the 4-in. and 60-in. levels were about 3 deg higher, the floor surface temperatures were about 10 deg lower and, of course, the heating load was greater.

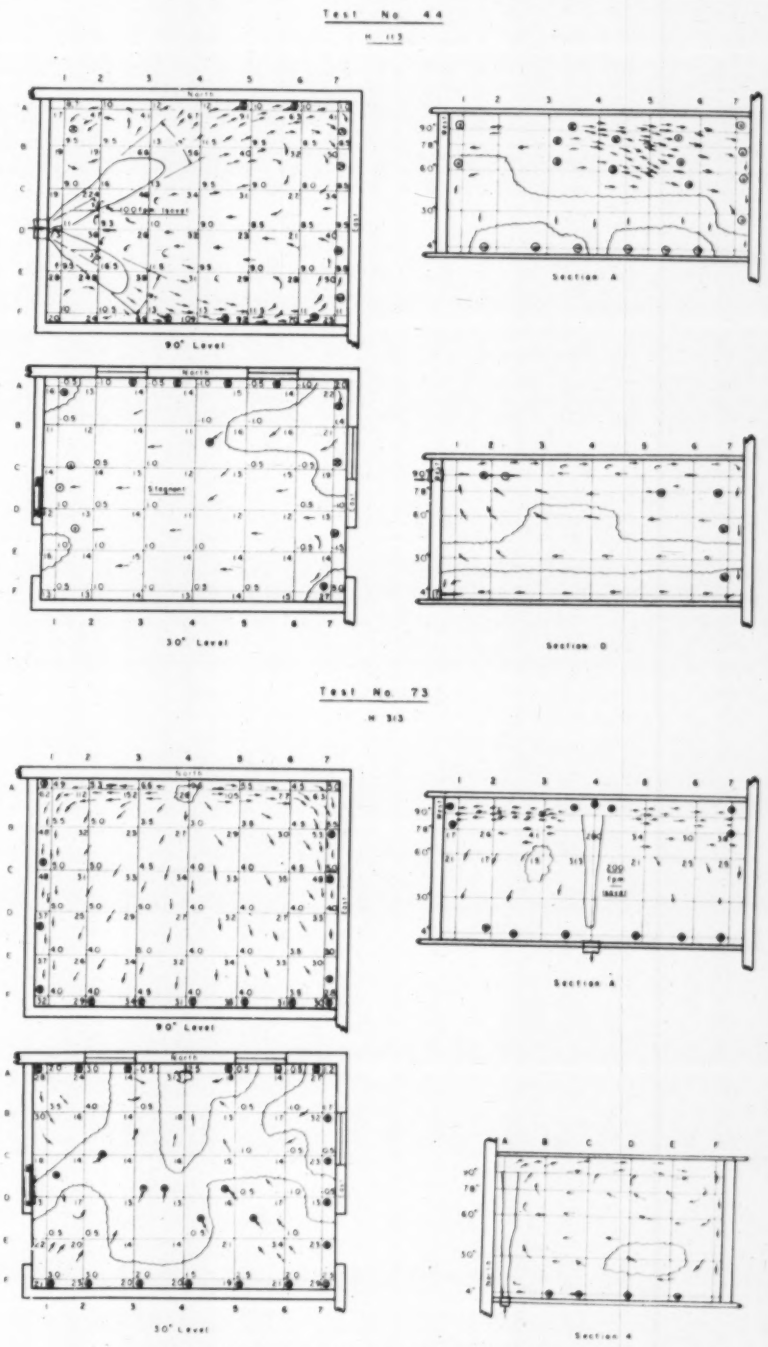

Fig. 6—Principal data of Tests Nos. 44 and 73

In other respects the air distribution was about equivalent for the two cases. Therefore, comparable air distribution in crawl-space applications evidently can be obtained by keeping the floor surface temperature as high as possible, a condition obtained, for instance, by properly insulating the floor.

The effect of storm sash was evaluated by repeating Tests Nos. 68, 73, 77, and 86 with storm sash installed. The results of these tests (Nos. 69, 74, 79, and 87) indicated that the air distribution was only slightly improved by the addition of storm sash. Referring to Col. 13 of Table 1, the sash resulted in only slight reductions in temperature variations in the room. Other than this, the effect was limited to some small reductions in the downward convection currents directly beneath the windows. From these studies it was concluded that while storm sash is desirable for reducing the heating load, it is not necessarily essential to obtain good air distribution in a room under winter heating conditions of operation.

Summer Cooling Studies

After analyzing the results of the winter heating studies, 16 tests were conducted under summer cooling conditions. Of these, 10 were conducted at the location which had provided the best air distribution during heating, Location III, and three each were conducted at Locations II and V.

Representative results for the cooling studies are shown by the diagrams for Test No. 55 in Fig. 8. The nominal supply-air velocity was 600 fpm and the nominal flow rate was 230 cfm, with a corresponding temperature differential between the supply and room air of 20 deg. This test and Test No. 57 in Fig. 5 provide an example of a year 'round system utilizing the same flow rate for winter heating and summer cooling.

Section F shows that the characteristics of the jets are very similar to those in the heating test, but the total air does not go above the 78-in. level. Sections 1 to 6 show that the buoyancy effect of the cool total air causes it to leave the jet and fall to the floor, resulting in a general motion across the floor, up the warm north wall, and back to the south wall at all levels above 4 in. The small temperature variations at the 4-in. level indicate that mixing of the jet and room air was very complete. A stagnation region is seen to exist from about the 70-in. level to the ceiling. This region has very high temperature variations, as shown by the diagrams of the 78-in. and 90-in. levels. Test No. 75 was conducted with Location III under the same conditions as Test No. 55 with Location II and the same general air motion was found for both tests.

Because of the stagnation region found in Tests Nos. 55 and 75, the level at which the stagnation region began was determined for various supply-air velocities. Hence, Tests Nos. 71, 81, and 82 had the same location and flow rate as Test No. 75, but had supply-air velocities of 494, 882, and 710 fpm. During Test No. 71 the total air was carried to the 60-in. level, and a stagnation region existed from this level to the ceiling; whereas, in Tests Nos. 81 and 82 the total air was carried to the ceiling and no stagnation region existed. From these tests it was determined that the minimum supply air velocity required to prevent a stagnation region occurring was of the order of 700 fpm for the floor diffusers.

Test No. 72 utilized a register with about the same flow rate and supply-air velocity as Test No. 75, which utilized a diffuser. No stagnation region was formed and the air distribution was good. Increasing the supply-air velocity, Test No. 80, also resulted in good air distribution.

By comparison of the data for the tests with both diffusers and registers in Location III, it was concluded that good air distribution can be obtained with a 20 deg differential with both floor registers and floor diffusers; also, for the optimum air distribution the required supply-air velocity is somewhat less for a register than for a diffuser. As previously reported[1], good air distribution was not obtained with the high side-

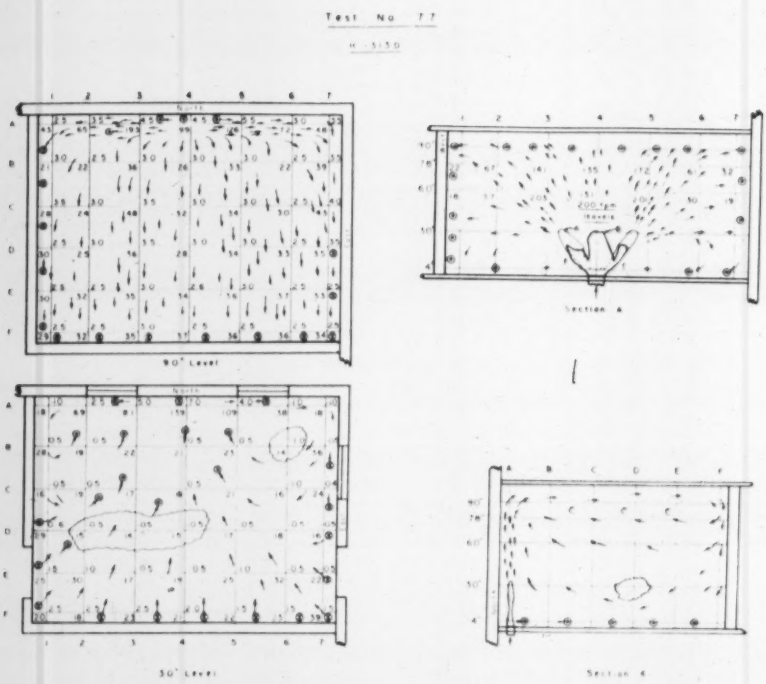

Fig. 7—Principal data of Test No. 77

wall outlets (Location I) and a 20 deg differential.

Tests Nos. 83, 85, 88, and 90, which were conducted with a flow rate of about 310 cfm and a temperature differential of 15 deg, included diffusers and floor registers as well as variable supply-air velocity. The temperature variations were very small for all of these tests. However, with a register and the higher supply-air velocity, the room air motion was excessively high. Also, the diffusers gave a more uniform room air motion than registers.

Comparison of the results obtained with supply outlets at three different floor locations indicate that the order of preference is Location III, II, and V. Therefore, a floor outlet located at the center of an exposed wall (Location III) evidently has excellent possibilities of providing good air distribution during year 'round air conditioning.

Isothermal Studies

Five tests were conducted under isothermal conditions with floor outlets at Locations II and III, and a portion of the principal data of one test is shown in Fig. 9. This test was conducted under the same flow conditions as the winter heating test of Fig. 7. Comparison of these data shows that the jet characteristics are the same for both. In addition, the room air motion, although greater in magnitude during the isothermal test, has a pattern nearly similar to that of the heating test. Such similar characteristics of isothermal and heating tests were also obtained during the other four isothermal tests. Hence, with floor outlets, under many conditions the room air motion during isothermal conditions will be representative of that which would be obtained under winter heating conditions. In contrast, the previous studies with high sidewall outlets indicated that the room air motion during isothermal conditions was representative of that obtained dur-

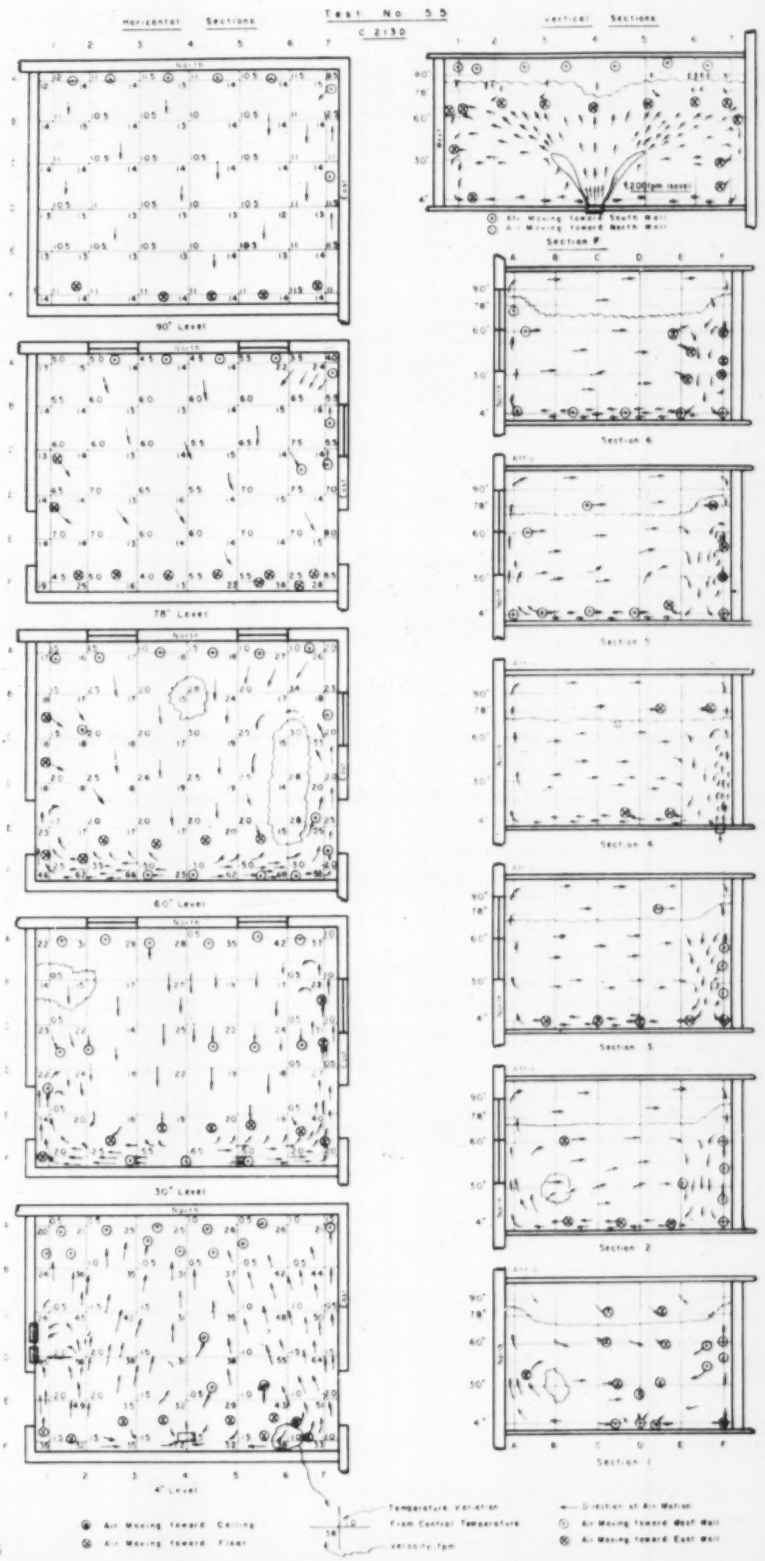

Fig. 8—Principal data of Test No. 55

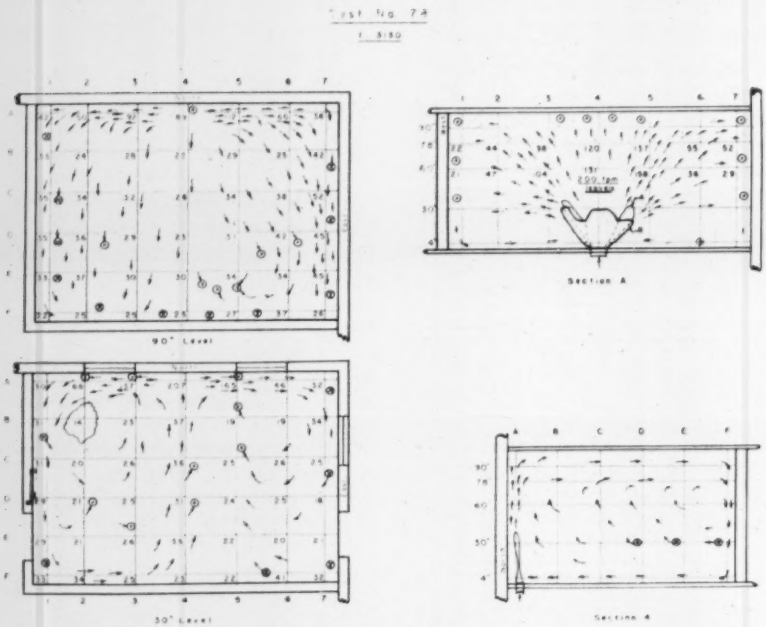

Fig. 9—Principal data of Test No. 78

ing the summer cooling conditions of operation.

With respect to a comparison of isothermal and summer cooling data with floor outlets in use, the room air motion was found to be significantly different. Even during the studies utilizing a high flow rate (small temperature differential) and a high supply-air velocity, gravitational forces had considerable influence on the flow pattern. Consequently, instead of a general motion across the ceiling and down the far wall that occurred under isothermal conditions, under summer cooling conditions of operation the air stream dropped into the occupied zone.

From these and previous isothermal studies it is concluded that, although under certain conditions isothermal and non-isothermal test conditions will yield similar air motion patterns in a room, the results of isothermal studies cannot generally be interpreted as predictions of the air motion in a room under either winter heating or summer cooling conditions of operation.

Summary of Results and Conclusions

1. During year 'round conditions of operation, better air distribution was obtained with floor outlets than with high sidewall outlets.

2. Floor diffusers produced a more uniform air motion and a lower temperature variation during heating than floor registers. Diffusers were especially effective in the unrestricted location near the center of the exposed wall.

3. With floor outlets and winter heating conditions of operation, an increase in supply-air velocity produced only a slight improvement in the air distribution. However, an increase in flow rate, with a subsequent lower supply-air temperature, resulted in a significant improvement. With a high sidewall outlet, either an increase in the supply-air velocity or the flow rate produced a significant improvement.

4. The best air distribution during cooling was obtained with outlets located near the center of the exposed wall. Under these conditions good air distribution was obtained with a temperature differential as large as 20 deg.

5. To obtain optimum air distribution during cooling, a higher supply-air velocity was required with floor diffusers than with floor registers.

6. For the simulated crawl-space conditions, the floor surface temperature was much lower and the temperature variation somewhat higher than those obtained under comparable heated-basement conditions.

7. Storm sash installed on the windows obtained only slight improvement in the air distribution.

8. Results obtained during isothermal studies cannot generally be interpreted as predictions of the air motion in a room under either winter heating or summer cooling conditions of operation.

9. A floor outlet located at the center of an exposed wall has excellent possibilities of providing good air distribution during year 'round air conditioning, particularly if the flow rate used during summer cooling is also used during winter heating.

Acknowledgment

This paper is a report of one phase of a research program being conducted under the terms of a cooperative research agreement between the *American Gas Association* (PAR Plan, *AGA* Project DGR-2-AC) and the Engineering Experiment Station of the University of Illinois. The broad objective of this research program, which was initiated in October 1947, is the improvement of air distribution systems for year 'round air conditioning. The material presented in this paper will ultimately comprise part of a University of Illinois Engineering Experiment Station Bulletin.

Acknowledgment is made for the advice and counsel rendered by the *AGA* Technical Advisory Group for Heating and Air Conditioning Research, and especially for the help and suggestions of W. F. Friend, H. C. Pierce, and G. F. Zellhoefer, Technical Advisors for the project.

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Skyline view showing portion of business section of Houston

Houston Host to ASHVE

ANOTHER MILESTONE in the Society's history will be achieved with the opening of the 60th Annual Meeting in Houston, Tex., January 25-27, 1954. Under the capable direction of D. M. Mills and R. J. Salinger, general chairman and vice-chairman respectively, of the Committee on Arrangements, plans for the meeting are proceeding with the speed of a prairie fire.

It was 60 years ago, in 1895, that the Society's first meeting was held in New York with an attendance of 45 members from a total membership of 75. The Committee on Arrangements anticipates that the attendance record of 1952 will be surpassed when the ASHVE meets in Houston.

The program for this forthcoming meeting, prepared under the guidance of the Program and Papers Committee, B. H. Spurlock, Jr., chairman, tentatively lists four technical sessions, presenting papers on a variety of subjects including cooling towers, automobile air conditioning, panel heating and controls, the heat pump and availability and utilization of solar energy, studies on air jets, physiological studies, room air distribution, the radiometer, cooling a home with a perimeter-loop duct system, and studies on heating of buildings.

Entertainment highlights will include a number of interesting diversions. Monday afternoon will feature a visit to the San Jacinto Monument and Battlegrounds where the Battleship Texas is moored in an estuary on the grounds.

The monument, 22 miles from Houston, rises 570 feet above the surrounding plain as a tribute to the men who gave their lives here in the great battle against Santa Anna in 1836. The Battleship Texas, which rendered valiant service during World War I and participated in the invasion of France in 1944, was offered to the State of Texas in 1945 by the Navy Department and was presented in 1948 to serve as a shrine for the citizens of the country.

There will be a dinner and get-

Committee on Arrangements

D. M. Mills, *General Chairman*
R. J. Salinger, *Vice-Chairman*

Banquet—A. B. Ullrich, Jr., *Chairman;* J. A. Wheeler, D. M. Robinson, A. M. Chase, Jr., J. N. Powell.

Entertainment—F. M. Neil, *Chairman;* N. L. Brown, D. S. Freese, M. E. Linn, H. E. Hope, Jr., O. G. Rivoire, Wesley Brown, D. C. McNeil, Reese Brentzel, H. R. Safford.

Finance—A. J. Natkin, *Chairman;* Willard Ammons, J. A. Poole.

Ladies—C. L. Fleming, *Chairman;* C. C. Quin; Mmes. A. F. Barnes, C. V. Chenault, D. S. Cooper, B. P. Fisher, C. L. Fleming, E. G. Floeter, J. C. Fontana, G. D. Hines, J. W. Holland, J. C. Lewis, D. M. Mills, I. A. Naman, E. H. McLane, F. M. Neil, W. N. Pauley, Dana Price, C. C. Quin, O. G. Rivoire, R. J. Salinger, W. A. Sharp, R. F. Taylor, A. B. Ullrich, Jr.

Honorary Chairmen
C. R. Gardner, Fort Worth, W. E. Long, Austin

Publicity—B. P. Fisher, *Chairman;* Wayne Holland, W. J. Way, II, B. J. Beaird, C. W. Warren.

Reception—E. G. Floeter, *Chairman;* Sidney Bromberg, H. O. Williams, J. C. Lewis, M. B. Peiser, G. T. Kerbow.

Sessions—I. A. Naman, *Chairman;* J. B. Buckley, W. L. Lashley, Jr., Bruce Appling, J. C. Fontana, Dallas Sullivan, G. D. Hines, Norman Rosenberg, S. F. Atlas.

Special Events—H. W. Broadwell, *Chairman;* B. P. Fisher, D. S. Cooper, F. R. Young, J. H. Stephenson, M. B. Peiser, H. G. McKee.

Transportation—A. F. Barnes, *Chairman;* A. E. Hess, C. V. Chenault, A. B. Banowsky, R. S. Sandifer, D. W. O'Brient.

Committee on Arrangements

Houston, Tex.

January 25-27, 1954

Honorary Chairmen

C. R. Gardner W. E. Long

D. M. Mills
General *Chairman*

A. J. Natkin, *Chairman*
Finance

R. J. Salinger
Vice-Chairman

I. A. Naman, *Chairman*
Sessions

B. P. Fisher, *Chairman*
Publicity

A. F. Barnes, *Chairman*
Transportation

H. W. Broadwell, *Chairman*
Special Events

C. L. Fleming
Chairman
Ladies

F. M. Neil
Chairman
Entertainment

E. G. Floeter
Chairman
Reception

A. B. Ullrich, Jr.
Chairman
Banquet

together party on Monday night at the San Jacinto Inn on the battlegrounds.

Inspection trips are planned for Tuesday afternoon and the Annual Banquet will be held on Wednesday night.

The Council will meet Sunday and again on Thursday, and there will be meetings of the Committee on Research, the Chapters' Conference Committee, and others including many of the Technical Advisory Committees.

Members are urged to mail the hotel reservation forms to the hotel of their choice immediately. These forms were sent to all members early in October.

It's *On to Houston* as January 25 draws closer. Make your plans now.

PROGRAM — 60th ANNUAL MEETING

The American Society of Heating and Ventilating Engineers
Rice Hotel, Houston, January 25-27, 1954

Sunday — January 24

10:00 a.m. REGISTRATION—Mezzanine Floor
10:00 a.m. Council Meeting
4:00 to 6:00 p.m. Rendezvous for coffee Texas style—South American Room
7:00 p.m. For your pleasure a group of tables have been reserved for Dinner, Floor Show and Dancing at the Shamrock Hotel. (Reservations required 2 weeks in advance. No set price—pay your own check)

Monday — January 25

9:00 a.m. REGISTRATION—Mezzanine Floor
9:30 a.m. FIRST TECHNICAL SESSION—Ballroom
Call to Order—By Reg. F. Taylor, President
Welcome to Houston
Response
Reports of Officers
Amendments to By-Laws

L. T. Mart, Chairman
Prediction of Cooling Tower Performance, by W. W. Smith
Automobile Air Conditioning—Progress and Problems, by P. J. Kent
Pressure Loss of Air Flowing Through 45-Degree Wooden Louvers, by Phil R. Cobb

12:30 p.m. Welcome Luncheon
Speaker: Morris Frank
2:00 p.m. Chapters Conference Committee Meeting
2:30 p.m. Boat and bus trip to San Jacinto Monument—See Ship Channel, Industrial District; Visit Battle Ground and Battleship Texas
6:00 p.m. Dinner at San Jacinto Inn

Tuesday — January 26

9:00 a.m. REGISTRATION—Mezzanine Floor
9:30 a.m. SECOND TECHNICAL SESSION—Ballroom
Call to Order—L. N. Hunter, 1st Vice President
Report of Committee on Research—R. S. Dill, Chairman

P. B. Gordon—Chairman
Circuit Analysis Applied to Load Estimating, by H. B. Nottage and G. V. Parmelee
Heat Flow Characteristics of Hot Water Floor Panels, by E. L. Sartain and W. S. Harris
Effects of Non-Uniformity and Furnishings on Panel Heating Performance, by L. F. Schutrum and C. M. Humphreys
Field Studies of Floor Panel Control Systems, Part II, by A. B. Algren, E. F. Snyder, Jr., and R. R. Head
Report of Tellers of Election

12:30 p.m. Ladies Luncheon and Fashion Show—Empire Room
1:30 p.m. Nominating Committee
2:00 p.m. Inspection trips to Public, Industrial and Business Buildings
6:30 p.m. Dinner a la Mexicaine—Informal Entertainment — Movies — Cards
7:00 p.m. Past Presidents' Dinner and Meeting

Wednesday — January 27

9:00 a.m. REGISTRATION—Mezzanine Floor
9:30 a.m. THIRD TECHNICAL SESSION—Ballroom
Call to Order by John E. Haines, 2nd Vice President

Prof. B. H. Jennings, Chairman
Costs of Operating the Heat Pump in the Equitable Building, by J. D. Kroeker and R. C. Chewning
Availability and Utilization of Solar Energy, by R. C. Jordan and J. L. Threlkeld
Part 1. Solar Energy Availability for Heating in the United States
Part 2. Utilization of Solar Energy for House Heating
Part 3. Design and Economics of Solar Energy Heat Pump Systems
Effects of Air Conditioning on Plant Growth, by F. W. Went

2:00 p.m. FOURTH TECHNICAL SESSION—Ballroom
Call to Order—Reg. F. Taylor, President

W. A. Grant, Chairman
Room Air Distribution Research for Year 'Round Air Conditioning—Part II, Supply Outlets at Three Floor Locations, by H. E. Straub and S. F. Gilman
Cooling a Small Residence Using a Perimeter-Loop Duct System, by D. R. Bahnfleth, C. F. Chen and H. T. Gilkey
A Two-Sphere Radiometer, by D. J. Sutton and P. E. McNall, Jr.
Unfinished Business
New Business
Resolutions

2:00 p.m. Ladies Theater Party—Playhouse Theater
7:00 p.m. Annual Banquet—Ballroom
Call to Order
Invocation
Installation of Officers
Speaker: Dr. Walter W. Kemmerer
Adjournment
Dancing

Thursday — January 28

9:30 a.m. Organization Meeting of Council

Summary of Chapter Meetings

HELANDER'S VISIT HIGHLIGHTS OREGON MEETING

The September meeting of the Chapter was highlighted by a talk by Prof. Linn Helander, head of the Mechanical Engineering Department at Kansas State College, who spoke on *Downward Projection of Heated Air.*

Professor Helander's discussion was an outline of the research data which have been compiled at Kansas State College under the cooperative research program sponsored by the Society. In this work at the College, studies have been made on down blow unit heaters in an attempt to develop suitable conversion factors for the various types of industrial units. The work at Kansas State College has been conducted with the assistance of the *Industrial Unit Heater Association.* Slides and sound movies were also presented which showed exactly how test data were obtained.

Pres. A. N. Hoss presided at the meeting and received a report from the Membership Committee Chairman, G. R. Folds. Mr. Folds listed three new members of the Oregon Chapter who were: J. P. Schenk, H. V. Soballe, and E. A. Brodie.

Linn Helander
guest of Oregon Chapter

• *ARKANSAS:* The speaker at the September meeting, Louis Stout, was introduced by Herman Cumnock, President. Mr. Stout gave an interesting address on various types of thermometers and their uses.

A social hour and dinner preceded the meeting, which began with the reading and approval of the reports on the treasury and membership drive. President Cumnock conducted a discussion regarding subjects available for the future meetings.

Oregon Chapter Officers and Board of Governors (l. to r.) J. E. Finkbeiner, secretary; W. B. Hayes; K. H. Hanson; A. N. Hoss, president; Dick Blankenship, treasurer; E. F. Kelly, vice president; and G. R. Folds, Jr.

• *DELTA:* Warren G. Moses, guest speaker for the September meeting, chose for his topic of discussion, *Air Conditioning System of the Texas Company Building.* Many questions followed this interesting presentation and Mr. Moses answered them fully and explicitly. Prior to this, Mr. Moses conducted a tour through the new Texas Company Building, which made his speech more enjoyable and illustrative.

A blanket invitation to the Delta Chapter, to witness the educational control shows to be in New Orleans October 5 and 6, was extended by Penn Controls, Incorporated.

In the absence of Pres. H. L. Salaun, Vice-President C. V. Bankston presided. J. J. Friedler, Jr., gave a very favorable report on the treasury; L. R. Maxwell thanked all members who had helped in the making up of the organization chart, and hoped that this excellent work would continue; and Walter Cooke, legislative and code chairman, reported on the recent Jefferson Parish group committee meeting. With the business of the evening completed, the meeting was adjourned.

• *EMPIRE STATE CAPITAL:* The first meeting of the fall season was opened by Pres. N. W. Burrill, who introduced two new members; D. A. McCreary and R. Peck. President Burrill called upon the Committee chairmen to present their reports which were discussed with the members present. Printed cards, showing the program for the coming year and also the Officers and Board members, were presented to each member. This form of program announcement was acclaimed by those present and a vote of thanks was given to E. C. Doyle who was responsible.

The Chapter was privileged to have three guest speakers. Dr. Essex was the first speaker and his topic was *The Operation of the Commission on School Buildings &*

Grounds. Heating and Ventilating of School Buildings and Grounds was presented by J. Churan, and D. Stevens spoke on the *Studies of the Staff of Consultants to the Commission regarding School House Construction and Lighting.* A lively discussion period followed these addresses and the appreciation of the Chapter was conveyed to Messrs. Churan, Stevens, and Dr. Essex for their very excellent presentations.

• *KANSAS CITY:* The September meeting was held at the Wishbone Restaurant and was called to order by Pres. G. H. Stoffer. After several committee chairmen presented their reports, the Board of Governors was introduced.

Vice-President F. K. Ladewig, presented the guest speaker, W. G. Wassmandorf of the Trane Company. *Engineering Analysis of the Refrigeration Cycle* was the subject of Mr. Wassmandorf's discussion. A lively question and answer period followed this interesting and enlightening talk.

Congratulations were offered to E. K. Campbell on the occasion of his 50th Wedding Anniversary which he and Mrs. Campbell celebrated, September 10.

• *NORTH TEXAS:* E. T. Keck, Jr. introduced the guest speaker, Jack Stewart, Dow Chemical Company, who discussed insulation and described the properties of insulation made of expanded polystyrene. A very interesting motion picture supplemented his information. Dean Emerson, of Houston, answered questions pertaining to the application of the insulation in an informative and entertaining discussion.

L. S. Gilbert announced that a report regarding the Giesecke Memorial Fund would be completed and ready for discussion at the next meeting as soon as comments from the South Texas and Southwest Texas Chapters were received.

Pres. P. N. Vinther called the September meeting to order, and the minutes of the previous meeting were approved.

• *NORTH TEXAS:* Guest speaker Fred McFadden, discussed in detail some of the technical problems of designing low temperature test chambers and how they were accomplished. All members present participated in the discussion period that followed and it was the unanimous decision that Mr. McFadden's talk was one of the finest presented before the chapter.

Pres. P. N. Vinther, who presided at the August meeting, called for the minutes of the previous meeting and these were read and approved.

• *ST. LOUIS:* The September meeting was held at Town Hall and was called to order by Pres. H. C. Sharp. Several reports were given by the Committee chairmen and special thanks was given to G. B. Pattiz, membership chairman for September, for his success in obtaining six new members for the Chapter. F. E. Ince, treasurer, presented his report and reminded all members about dues. Pres. H. C. Sharp announced that E. T. Clucas had been elected second vice-president by the Board of Governors to replace J. F. Naylor, Jr. who has moved to another city. It was also announced that W. A. Russell had been elected Secretary-Treasurer of Joint Council of *Engineers Society of St. Louis.*

B. L. Evans and President Sharp commented most favorably on the Society's Denver meeting. There was a good representation from St. Louis and slides were shown of pictures taken at Denver.

The guest speaker, G. F. Robinson of Carrier Corporation, spoke on *Trends in Year-Around Air Conditioning for Residences.* All phases of this field were discussed, including the pitfalls in residential air conditioning; air distribution and noise. The meeting was adjourned after a hearty round of applause was given to Mr. Robinson.

• *SOUTHWEST TEXAS:* Pres. D. E. Locher called the September meeting to order at the Belgium Inn. After the reading and acceptance of the August minutes, several reports were presented on activities which involve different committees and projects of the Chapter's. Boone Crisp and I. W. Wilke reported on the progress of the Chapter's Committee on the Student Aid Fund. F. B. Frazee agreed to attend the South Texas Chapter in order to further this activity. A Chapter Committee on Student Chapter Activity has also been organized with I. W. Wilke as chairman; assisted by B. J. Barnhart and J. L. Rea, Jr. W. J. Brinkmann also presented a report on the NAHB projected *Air Conditioned Village.*

L. H. Hornor, Jr. presented the speaker of the evening, Wm. Palin of Cutler-Hammer's Houston office. Mr. Palin discussed motor starting devices, illustrated by slides; Primary Resistance Reduced Voltage Starters, Auto-Transformer Reduced Voltage Starters, and Part-Winding or Increment Starters, which he used as examples when discussing reduced voltage starting; and the importance of using a three coil overload relay for motor protection. The need for the latter is due to the increasing residential area use of three phase service and its usual condition of an unbalanced voltage which is responsible for the burning-out of motors.

• *VIRGINIA:* The September meeting was presided over by Pres. E. D. Duval in the assembly room of the Henry Walke Company. With the minutes from the previous meeting read and approved, the guest speaker was introduced by M. H. Pelosi, Jr. The speaker of the evening was W. L. Sammons, district manager of the Charlotte Division, Carrier Corp. *Residential Air Conditioning,* was the subject of Mr. Sammons talk and it proved to be informative and interesting. After a lively discussion period, the meeting was adjourned.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 72 applications for membership, including 2 reinstatements; in addition 8 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by November 30, 1953, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement

California

△BROWN, C. L., JR., Engrg. Officer, Corps of Engineers, Beale Air Force Base. REFERENCES: T. O. S. Humphrey, Jr., J. E. Hurston*, S. Konzo, Ray Reilly*.

BURRIER, H. E., Mech. Engr., Southern California Edison Co., Los Angeles. REFERENCES: L. B. Davenport, M. C. Greiner, A. Hanson*, Stanley Polland.

GERICH, E. P., Engr., L. J. Wing Mfg. Co., Los Angeles. REFERENCES: V. W. Sharpe, G. F. Sleight, C. H. Smith, H. S. Wheller.

KRAGE, R. F., Owner, R. F. Krage, Mech. Engr., Stockton. REFERENCES: H. S. Haley, J. F. Kooistra*, L. A. O'Meara, P. L. Sala*.

SODERHOLM, N. L., JR., Sales Engr. American Air Filter Co., Los Angeles. REFERENCES: R. V. Sloan*, C. B. Spencer*, J. B. Macomber, R. C. Taylor.

WEISENBERG, E. L., Air Conditioning Engr., Southern Counties Gas Co., El Monte. REFERENCES: L. B. Davenport, E. C. Evans, C. R. Kidd, Carleton Raymond.

Connecticut

JOHNSON, E. M., Associate, Marchant & Minges, Engrs., West Hartford. REFERENCES: R. B. Cahoon, E. J. Hoagland, D. M. Hummel, C. G. Marchant*.

District of Columbia

MORGAN, J. W., Engr., Johnson Service Co., Washington. REFERENCES: S. R. Allen, W. C. Jones, G. R. Walz, F. H. Weller.

Illinois

CARR, J. W., Sales Engr., Kewanee Ross Corp., Chicago. REFERENCES: J. M. Hartman, R. B. Mason, C. F. Olsen, W. B. Russell.

DESPINS, G. R., Mgr., Heating Sales, Raymond Fisher Supply Co., Chicago. REFERENCES: H. G. Gragg, H. T. Kucera, F. W. Luft, Jr., E. R. Teske.

Indiana

†BAKER, H. J., Sales Engr., H. C. Gammon Co., Inc., Indianapolis. REFERENCES: J. T. Hardin, J. W. Jackson, R. O. Jackson, J. R. Loggins.

NESSLER, R. L., JR., Sales Engr., DeHaven Engrg. Co., Indianapolis. REFERENCES: O. E. Cotton, T. R. Davis, G. J. Hayes, S. H. Perham.

Kansas

△WAALKES, R. J., Technical Training Director, The Coleman Co., Inc., Wichita. REFERENCES: J. W. Kice, C. L. Grandstaff, C. H. Pesterfield, C. M. toeLaer.

Louisiana

COLTON, EDWIN T., II, Merchandising Mgr., Industries Sales Corp., New Orleans. REFERENCES: C. V. Bankston, L. V. Busenlener, J. D. Maddox, H. L. Salaun.

DUDLEY, W. H., III, Air Conditioning Engr., Cary B. Gamble and Assocs., New Orleans. REFERENCES: C. B. Gamble, J. E. Leininger, W. B. Martin, T. A. Stokes.

KENNEDY, H. M., Mech. Engr., District Public Works Office, New Orleans. REFERENCES: W. J. Daussat, Marcel Livaudais, W. B. Logan*, Edward Yoerger*.

Massachusetts

PETROLATI, V. J., Mech. Engr., Air Installations Office, Westover Air Force Base. REFERENCES: A. M. Lovenberg, B. M. Packtor, F. C. McClean, John Slattery*.

Michigan

△LIEBER, J. M., Engr., State Plumbing & Heating Supplies, Inc., Detroit. REFERENCES: I. W. Chase, H. P. Osgood, R. H. McGeorge, F. H. Patterson.

TARSKE, R. S., Design Engr., Thomas J. Black, Cons. Engr., Harper Woods. REFERENCES: T. J. Black, D. S. Falk, R. H. Oberschulte, M. F. Outwater.

Minnesota

BERGHORST, K. B., Asst. Mgr., Duffy Heating Co., Anoka. REFERENCES: G. T. Costello, H. R. Bostrom, Leland Lincoln, F. H. Schneeberg.

COOK, R. E., Heating Sales Engr., Standard Plumbing & Heating Supply Co., Minneapolis. REFERENCES: A. B. Algren, J. V. Borry, R. L. Campbell, J. C. Englebretson.

HALLBERG, W. C., Sales Engr., McQuay, Inc., Minneapolis. REFERENCES: C. L. Cich, O. L. Lilja, R. W. Otto, J. F. Pfost.

Mississippi

ENGLAND, N. F., Repr., Metalbestos Division, William Wallace Co., Jackson. REFERENCES: C. E. Blome, J. G. Coleman, Jr., J. M. McGregor*, I. E. Rowe.

Missouri

HENSELY, J. C., Contract Engr., The Marley Co., Kansas City. REFERENCES: H. E. Degler, W. O. Kretzmeier, O. G. Linimon, L. T. Mart.

POWELL, R. J., Mgr. Merchandising Dept., The Marley Co., Kansas City. REFERENCES: H. E. Degler, W. O. Kretzmeier, O. G. Linimon, L. T. Mart.

THOMPSON, J. B., Sales Engr., The Marley Co., Kansas City. REFERENCES: L. A. Heaven, W. O. Kretzmeier, O. G. Linimon, L. T. Mart.

Nebraska

ACQUAZZINO, F. J., Repr., Air Conditioning Utilities, Inc., Omaha. REFERENCES: S. W. Black, N. M. Blanchard, G. W. Colburn, A. R. Dennell.

BANKER, P. E., Repr., Air Conditioning Utilities Inc., Omaha. REFERENCES: S. W. Black, G. W. Colburn, E. A. Snellenberg, T. D. Williams, Jr.

PETERSON, T. W., Branch Mgr., Barber-Colman Co., Omaha. REFERENCES: V. P. Hansen, R. G. Koch, L. C. Plaehn, H. H. Valiquet.

WILLIAMS, T. D., JR., Repr., Air Conditioning Utilities Inc., Omaha. REFERENCES: S. W. Black, G. W. Colburn, A. R. Dennell, E. A. Snellenberg.

New Mexico

WHERRITT, C. R., Section Leader, University of California Scientific Lab., Los Alamos. REFERENCES: J. K. James, S. A. Musser, E. F. Ross, B. H. Spurlock, Jr.

New York

BECKETT, A. R., JR., Sales Engr., Goergen-Mackwirth Co., Inc., Buffalo. REFERENCES: I. R. Kahn, L. N. Hopkins, Jr., C. W. Stone, J. J. Yager.

CUMMINGS, R. N., Instructor, State University of New York, Agricultural and Technical Institute, Canton. REFERENCES: J. R. Carroll, Jr., H. T. Gilkey, S. Konzo, W. F. Stoecker*.

DOYLE, R. L., Engr., Carrier Corp., New York. REFERENCES: O. W. Armspach, Albert Giannini, E. H. Leveridge, J. G. Marshall.

ESTEY, C. G., Sales Engr., Albany. REFERENCES: L. V. Appleby, J. E. Hart, J. L. Ottenheimer, R. J. Tougher.

LEPSELTER, B. H., Design Engr., The J. M. Fink Co., Inc., New York. REFERENCES: Nathan Feder, F. A. Fideli, J. M. Fink, Bernard Leventhal.

MARTIN, J. R., Application Engr., Carrier Corp., New York. REFERENCES: R. H. Leveridge, J. G. Marshall, Americo Silvera, F. B. Wilder.

MATTHEWS, R. E., Engr., American Gas & Electric Service Corp., New York. REFERENCES: E. R. Ambrose, R. B. Darling, F. R. Ellenberger, P. C. Hutchins.

△MINTON, JOSEPH, Engr., S. J. O'Brien Sales Corp., New York. REFERENCES: L. M. Grad*, E. P. Del Campo*, Raymond Garramone*, Ralph Torop.

MORIN, H. L., Designer, Robson & Woese Inc., Cons. Engrs., Syracuse. REFERENCES: H. K. Ormsby, P. D. Robson, J. W. Stevens, C. F. Woese.

†O'CONNELL, V. J., Sales Engr., General Electric Supply Co., Brooklyn. REFERENCES: E. E. Ashley, H. H. Bond, S. A. Spencer, J. E. Schechter.

SCHWARTZ, J. R., Secy.-Treas., Infra Insulation Inc., New York. REFERENCES: Stanley Blumenstein, H. J. Harris, L. G. Huggins, S. J. Storper.

WADDELL, M. E., Branch Mgr., The Powers Regulator Co., Albany. REFERENCES: D. A. Carofano, A. H. Moraweck, F. A. Murray, Merle Weninger.

WUHRMAN, W. H., Partner, W. R. Cosentini & Assocs., New York. REFERENCES: R. H. Carpenter, A. F. Hinrichsen, J. W. McGuire, Ira Willner.

North Carolina

△BEAN, R. F., Engr., Air Conditioning Corp., Greensboro. REFERENCES: P. L. Guest, Jr., Harry Hoffman, J. M. Pleasants, J. W. Westbrook.

Ohio

GRAF, C. R., Mgr., Heating Dept., Graf & Sons, Inc., Columbus. REFERENCES: A. D. Bogen, F. W. Gurley, H. G. Hays, N. T. Hess.

MCANDREWS, R. F., Sales Mgr., Russell R. Gannon Co., Cincinnati. REFERENCES: R. C. Beineke, H. K. Jennings, Nathan Frankel, R. R. Gannon.

Oregon

HELT, G. E., Service Installation Mgr., Minneapolis-Honeywell Regulator Co., Portland. REFERENCES: Dick Blankenship, W. D. Maxwell, T. H. McClung, K. H. Hanson.

Pennsylvania

CLAY, R. H., Mgr., Engineering Service Dept., A. M. Byers Co., Pittsburgh. REFERENCES: C. L. Benn, W. J. Binder, P. S. Park, Jr., W. J. Mayer.

†SCHMIDT, H. L., Sales Mgr., Halstead & Mitchell, Pittsburgh. REFERENCES: W. A. Allen, E. H. Riesmeyer, Jr. C. H. Schneider, J. N. Riley.

South Carolina

GARDNER, F. R., Exec. Secy., S. C. Assn. of Plbg. & Htg. Contrs., Columbia. REFERENCES: R. H. Crum*, C. B. Kneller*, R. J. McCarley*, Jr., J. H. Sams*.

JENKINS, A. H., Mech. Engr., U. S. Naval Shipyard, Charleston. REFERENCES: A. L. Blackstone, Jr., M. R. Durlach, Jr., F. B. Herty, J. R. Johnson*.

MCLAIN, R. S., Repr., Clark Heating Co., Inc., Columbia. REFERENCES: J. W. Clark, Jr., Robert Lindsey*, Vance Morrow, Bill Wannamaker*.

MORROW, V. A., Partner, Hoffman & Hoffman Co., Columbia. REFERENCES: R. K. Demarest, Jr., M. R. Durlach, Jr., F. B. Herty, L. B. Hoffman.

MYERS, J. N., Air Conditioning Engr., T. Louis Murray, Columbia. REFERENCES: P. H. Erisman, Jr. R. E. Mason, E. H. McLane, J. H. Skipper.

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OBITUARIES

CLARK T. MORSE
Bloomfield Hills, Mich.

The Society was saddened by the news of the death Sept. 18 of Clark T. Morse, a life member of ASHVE and president of the American Blower Corp. and the Canadian Sirocco Co. Mr. Morse, who was in his 67th year, had suffered a brief illness.

Mr. Morse was born in Evanston, Ill., Dec. 31, 1886. He began his career with American Blower in 1912 as a salesman and became president of the company in 1933. In addition to his position as president of American Blower and Canadian Sirocco at the time of his death, he was also a director of the American Radiator and Standard Sanitary Corp., parent corporation of the other two concerns.

Mr. Morse had been a member of ASHVE since 1913, and was elected to life membership in 1945. In addition to the Society, he was also a member of ASME, the Recess Club of Detroit, the Engineers Club of New York City, the *Engineering Society of Detroit*, and the Detroit Athletic Club. Mr. Morse was active in the *National Association of Fan Manufacturers* and in many civic and charitable organizations.

Clark T. Morse

Surviving are two daughters, Barbara of Bloomfield Hills and Louise of Santa Monica, Calif., to whom the Officers and Council extend their sincerest sympathy.

FRANK H. PATTERSON
Grosse Pointe, Mich.

The news of the death of Frank H. Patterson, sales engineer, Hoffman Specialty Co. and Fedders-Quigan Corp., Grosse Pointe, Mich., has been received by the Society. Mr. Patterson was 57 years old.

Born April 27, 1896, in Austin, Pa., Mr. Patterson attended public schools in Davis, W. Va., studied engineering at the University of West Virginia from 1916 to 1917, and received his M. E. degree from the University of Detroit in 1924. From 1920 to 1926 he was also employed as a student engineer for the Detroit Edison Co., spending 2 years in its research laboratory and 4 years in its central heating department. In 1926 he joined the Hoffman Specialty Co. as a salesman, remaining with the company until his death. Mr. Patterson had been a member of the Society since 1942.

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● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, Fourth Wednesday. PRESIDENT, C. R. Acheson, 306 W. Genesee St. SECRETARY, H. K. Ormsby, 205 S. Townsend St. (2).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, Third Monday. PRESIDENT, N. T. Hess, 63 E. Goodale St. SECRETARY, R. A. Wilson, 20 S. Third St., (15).

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, R. C. Beineke, 626 Broadway, (2). SECRETARY, A. H. Gerdsen, 224 E. Second St., (2).

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, Third Thursday. PRESIDENT, G. F. Nieske, 165 Maple St., Naugatuck. SECRETARY, E. J. Hoagland, 257 S. Whitney St., Hartford.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, Third Tuesday. PRESIDENT, H. L. Saloun, 317 Baronne St. SECRETARY, T. J. Jenny, 1000 S. Peters St., (9).

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. Meets, Second Wednesday. PRESIDENT, N. W. Burrill, 33 Riverside Ave., Rensselaer. SECRETARY, L. V. Appleby, R.D. 2, Watervliet.

● **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, First Thursday. PRESIDENT, J. E. Murray, 350 Mission St. (5). SECRETARY, D. E. McLeod, 3740 Clay St. (18).

● **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, Second Monday. PRESIDENT, H. G. Chapin, 185 N. Wabash Ave., (1). SECRETARY, H. G. Gragg, Rm. 1310, 228 N. LaSalle St. (1).

● **INDIANA:** 1943. Hdqrs., Indianapolis, Ind. Meets, Fourth Tuesday. PRESIDENT, R. C. Blackman, 5505 N. Illinois St., (8). SECRETARY, J. W. Jackson, 3514 N. Drexel, (18).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, G. M. Dieter, 917 W. Mallon. SECRETARY, F. W. Jenkinson, N. 1904 Smith St., (15).

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, J. F. Sandfort, Iowa State College, Ames. SECRETARY, G. J. Kraai, 907 Sixth Ave. (14).

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. Meets, Tuesday after First Monday. PRESIDENT, R. L. Pennington, 520 So. Commerce (2). SECRETARY, O. B. Strahm, 601 So. Terrace Dr.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, G. H. Stoffer, 200 Riss Building (6). SECRETARY, A. S. Hurt, Jr., 2119 Washington St., (8).

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Third Thursday. PRESIDENT, A. K. Piercy, 222 Osborne St. N. SECRETARY, D. B. Brace, 1550 Dublin Ave.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, A. L. Hare, 127 Federal St. (10). SECRETARY, W. G. Martin, Jr., 20 Winchester St. (16).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, W. L. Drake, 15 N. Reese. SECRETARY, A. T. Bevil, 1638 Union Ave. (4).

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT, John Schweiger, 593 Acorn Drive, Dayton (9). SECRETARY, D. E. Tullis, 743 Kiser St. (4).

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, R. H. Oberschulte, 316 McKerchey Building, (1). SECRETARY, D. S. Falk, 4864 Woodward Ave. (1).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, V. E. Pearson, 739 Marquette Ave. (2). SECRETARY, E. T. Erickson, 500 Baker Arcade.

● **MISSISSIPPI:** 1953. Hdqrs., Jackson, Miss. PRESIDENT, Burt Lomax, Jr., P. O. Box 1662. SECRETARY, J. G. Coleman, 2840 Arbor Hills Drive.

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, B. J. Horsburgh, 940 Ogilvy Ave. (15). SECRETARY, R. J. Ker, 1000 Beaver Hall Hill, P. O. Box 340.

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, O. J. Smith, 233 Grain Exchange Bldg. (2). SECRETARY, C. A. Failor, 5736 N. 33rd St. (11).

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, J. E. Schechter, 28 Brower Ave., Woodmere, L. I. SECRETARY, Carl H. Flink, 62 Worth St. (13).

● **NORTH JERSEY:** 1952. Hdqrs., Newark, N. J. Meets, Second Tuesday. PRESIDENT, F. H. Faust, 5 Lawrence St., Bloomfield. SECRETARY, C. H. Smith, 2490 Vreeland Mills Rd., Linden.

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, P. N. Vinther, 929 Mercantile Securities Bldg. SECRETARY, J. A. Ray, 4411 Belmont Ave. (4).

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, Second Tuesday. PRESIDENT, J. N. Watt, 528 E. Fifth. SECRETARY, J. C. Netherton, Jr., 3130 E. 44th St.

● **NORTHERN OHIO:** 1916. Hdqrs. Cleveland, Ohio. Meets, Second Monday. PRESIDENT, J. M. Black, 1296 Gordon Rd., Lyndhurst. SECRETARY, M. L. Erickson, 7218 Euclid Ave., (3).

● **NORTHERN PIEDMONT:** 1952. Hdqrs., Greensboro, N.C. Meets, Second or Third Friday. PRESIDENT, J. E. Hart, 1001 E. Bessemer Ave. SECRETARY, S. T. Oliver, 2307 Fairfield Ave.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, F. X. Loeffler, Jr., Box 529. SECRETARY, G. E. Ervin, 2520 N. W. 23rd St.

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, N. W. Kingsland, 31 Willcocks St. SECRETARY, H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, A. N. Hoss, 621 S.W. Alder (5). SECRETARY, J. E. Finkbeiner, 10260 S.W. Daphne Pl. (1).

● **OTTAWA VALLEY:** 1952. Hdqrs., Ottawa, Ont., Canada. Meets, Third Tuesday. PRESIDENT, G. L. Ostiguy, 282 Westhill Ave. (3). SECRETARY, N. J. Howes, Box 264, R. R. 1.

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, H. T. Orebaugh, 1330 Dearborn. SECRETARY, L. F. Christofferson, 7358-58th Ave. N.E., (5).

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, C. F. Dietz, 3449 W. Indiana Ave. (32). SECRETARY, P. H. Yeomans, Architects Building (3).

● **PITTSBURGH:** 1919. Hdqrs. Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, C. H. Schneider, 310 Washington Rd. SECRETARY, E. H. Riesmeyer, Jr., 431-33 Water St. (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, First Wednesday. PRESIDENT, H. L. Wray, 1101 Geneva St., Aurora. SECRETARY, J. F. Cipra, Jr., 2676 S. Madison St.

● **SACRAMENTO VALLEY:** 1952. Hdqrs., Sacramento, Calif. Meets, First Wednesday. PRESIDENT, E. C. McKinsey, 4220 Annette (21). SECRETARY, R. A. Sarro, 5412 Argo Way.

● **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, H. C. Sharp, 4060 W. Pine Blvd. (8). SECRETARY, W. P. Norris, 1118 Fullerton Bldg.

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, M. A. Hudson, 753 Gladstone Blvd. SECRETARY, R. S. Segall, 603 Cotton St.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, E. G. Floeter, Jr., P.O. Box 6006 (6). SECRETARY, F. M. Neil, 3513 W. Dallas Ave. (19).

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, L. B. Davenport, 137 S. Anderson St. (33). SECRETARY, J. L. McCullough, 1978 S. Los Angeles St. (11).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRESIDENT, R. E. Mason, 1726 Hutchinson Ave. (1). SECRETARY, S. B. Blanton, Box 6096.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, D. E. Locher, Box 949, Corpus Christi. SECRETARY, F. B. Frazee, 1013 Riverside Dr., Austin.

● **UTAH:** 1944. Hdqrs., Salt Lake City, Utah. Meets, Third Thursday. PRESIDENT, M. L. Gollaher, 1163 Roosevelt Ave. (5). SECRETARY, G. L. Soderborg, Sr., 42 E. 8th St. S.

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, E. D. Duval, 1023 Hanover Ave. SECRETARY, T. B. Carpenter, 412 Chester St.

● **WASHINGTON, D. C.** 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, J. G. Muirheid, Bureau of Ships, Navy Dept. (25). SECRETARY, W. C. Reamy, Jr., 17th & Pennsylvania Ave., N. W. (6).

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, J. T. Anderson, Michigan State College, East Lansing. SECRETARY, N. A. Buckley, 514 Park Rd., Jackson.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, C. W. Stone, 1219 Main St. (9). SECRETARY, C. W. Kaupp, 271 Delaware Ave.

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, N. E. Hill, 122 N. Hartwell Ave., Waukesha. SECRETARY, K. H. Forfar, 2711 N. 27th St. (10).

SPECIAL BRANCH

● **SWISS:** 1952. Hdqrs., Zurich, Switzerland. PRESIDENT, Leo de Bruyn, Muhlebachstr. 172, Zurich. SECRETARY, Walter Hausler, Erbstrasse 2, Kusnacht, Zurich.

STUDENT BRANCHES

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Sydney Narvey, 5-B Vetville, State College Station. SECRETARY, E. A. Travis, Jr., P.O. Box 3332, College Station.

● **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. Address mail to: Prof. R. R. Irwin, Dept. of M. E., Oklahoma A. & M. College.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, R. E. Bulletsel, 252 Kings Rd. SECRETARY, I. P. Parkhurst, 1354 Harrison.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, N. J. Kirch, 922 Highland Ave., Lafayette. SECRETARY, H. F. Allen, Jr., 629 University St.

● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station, Tex. Meets, Second and Fourth Tuesday. PRESIDENT, C. E. Beavers, Box 4083. SECRETARY, C. R. Blank, Jr., Box 2021.

● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, J. R. Cairns, 4001 Florence, (21). SECRETARY, W. F. Thull, 18313 New Jersey (19).

● **UNIVERSITY OF KANSAS:** 1949. Hdqrs., Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, H. M. Braymer, 1307-C Brackenridge Apts., (3). SECRETARY, A. D. Wilkinson, Jr., 1423-B Brackenridge Apts., (3).

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont. CHAIRMAN, D. S. Harper, 737 Sammon Ave. SECRETARY, L. S. Mitchell, 88 Lawrence Crescent.

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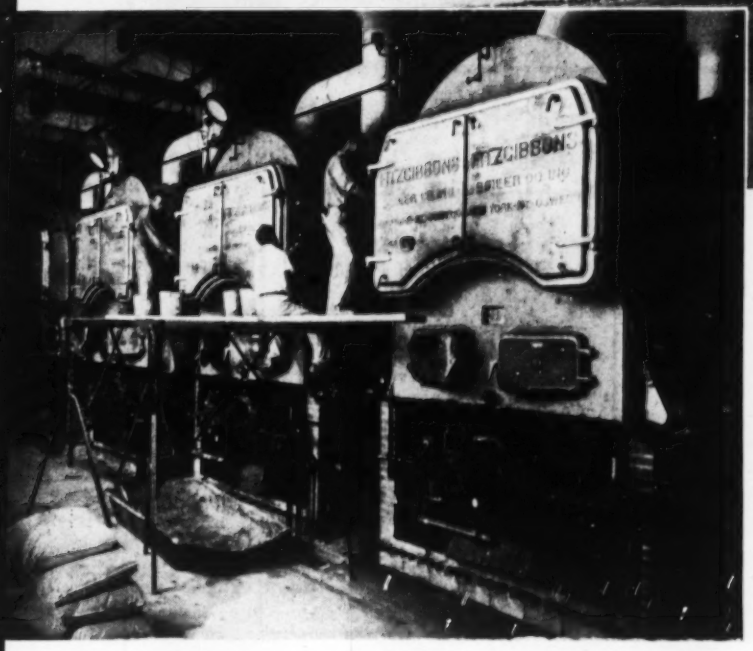

HERE IS ANOTHER of the many up-to-the-minute schools that enjoy the economy and abundant heating comfort of Fitzgibbons Steel boilers. Four Fitzgibbons "D" Type boilers handle the heating job with ease in the most severe New England winter, and do it with the outstanding fuel savings for which these boilers are famed in schools, colleges, and institutional buildings throughout the nation. School boards everywhere have learned that "the best boiler buy is Fitzgibbons."

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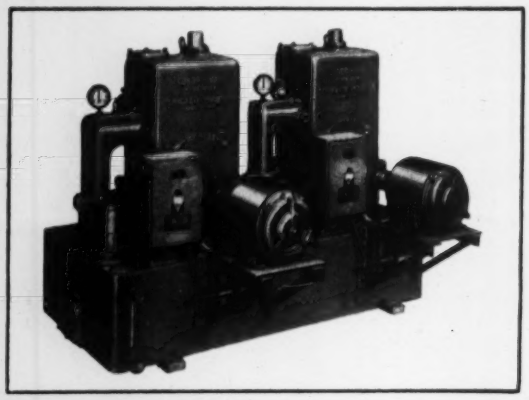
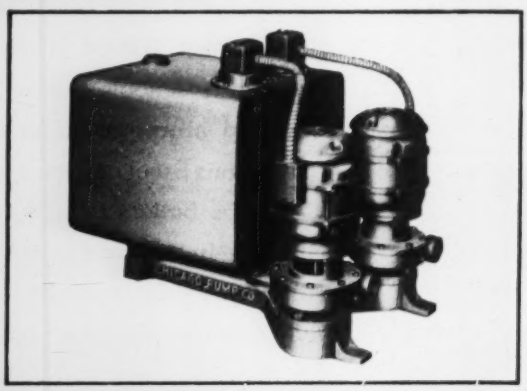


DUPLEX CONDO-VAC RETURN LINE VACUUM AND BOILER FEED PUMP

Specifically designed for vacuum heating systems. The water capacity of the Condo-Vac remains constant up to the boiling point. The air capacity remains constant to the evaporation point. Pressures up to 40 lbs. Capacities from 2500 to 150,000 EDR. Described in Bulletin 270.



SURE RETURN CONDENSATION PUMP & RECEIVER

For systems up to 75,000 EDR and for low and medium pressures. Available in either single or duplex units. The base serves as a large capacity manifold through which the condensate flows by gravity from the receiver to the pump. The Sure Return will not steam bind. Described in Bulletin 250.

CHICAGO PUMP COMPANY

BUILDING and INDUSTRIAL DIVISION

622 DIVERSEY PARKWAY — **CHICAGO 14, ILLINOIS**

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HEATING PUMPS

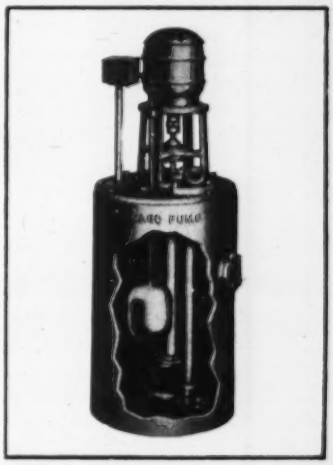
For every heating system get the pump that is specifically designed for the particular job. For below floor returns, for low vacuum systems, for small capacity high pressure requirements, for any standard heating system, or any unusual condition, there is a CHICAGO Heating Pump that will do the job better. All ratings and receiver capacities meet or exceed ASHVE standards.

TYPE AVC CONDENSATION PUMP & RECEIVER

Heavy cast iron receiver with low inlet for floor mounting or shallow pit. Sets on floor—no foundation bolts necessary. Weight of unit and piping hold unit firmly in place. For 500 to 10,000 EDR and 10 to 30 lbs. pressure. See Bulletin 245.

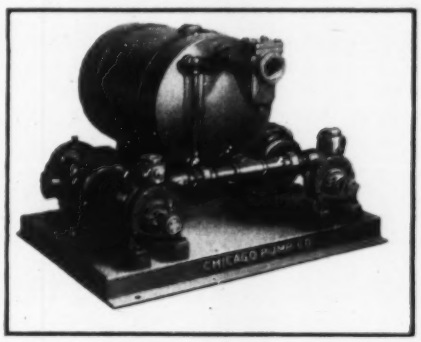
TYPE CLL1 VERTICAL CONDENSATION PUMP & RECEIVER

Specifically designed for low return service and underground installations. Flanges are accurately finished and gasketed to prevent steam leaks. Pump and receiver are shipped as a unit, ready to install. For 1000 to 40,000 EDR and 10 to 25 lbs. pressure. Described in Bulletin 255.

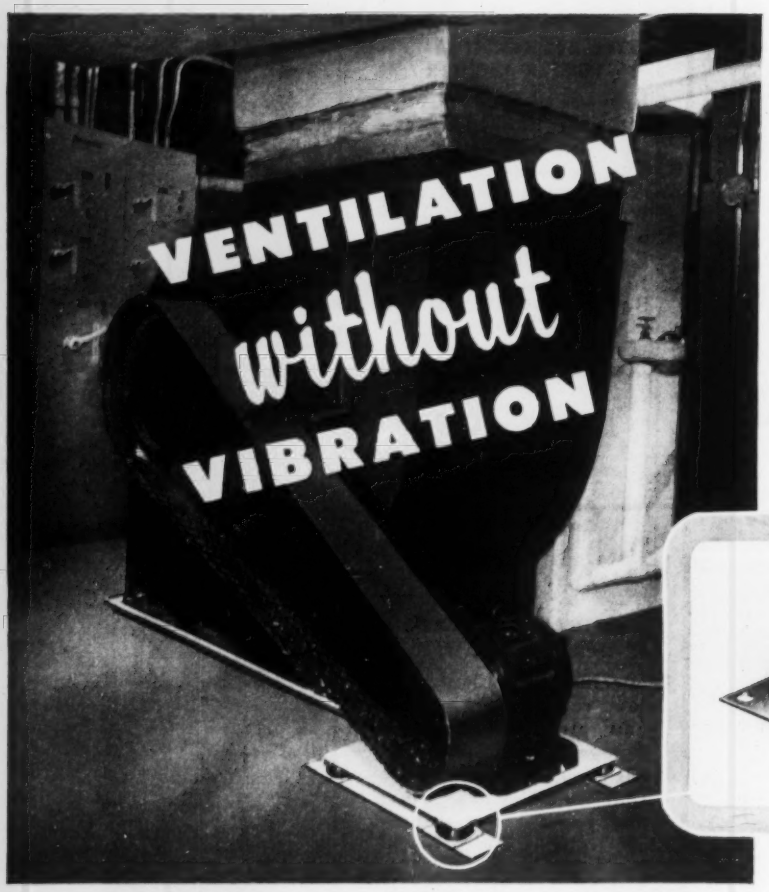


DUPLEX FC CONDENSATION UNIT

Single or duplex units are specifically designed for operating conditions where pressures are high and capacities relatively small. For duty up to 50,000 EDR and discharge pressures up to 150 lbs. Described in Bulletin 260.



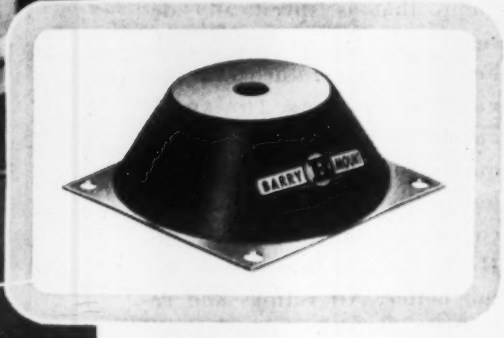
CHICAGO INDUSTRIAL PUMPS



The new Barry fan bases are designed to achieve maximum efficiency in reducing noise and vibration transmitted from heating and ventilating fans and air-conditioning units.

They are engineered by The Barry Corporation, leaders in the field of vibration-isolating equipment for military use, to apply the most up-to-date knowledge to this problem.

Their detailed design is completed for each particular installation *to meet the exact requirements of that installation*, because this is the only way to assure *maximum performance*.



Noise and vibration from heavy motor-driven blowers proceed partly through the air, from the fan blades and other moving parts of the machinery, and partly by transmission through the building structure from the supporting base.

The key to effective reduction of both vibration and audible noise is a properly-designed isolating support, specifically engineered to take account of the weight of the fan and its motor and housing, the location of the center of gravity, and the operating speed. Barry fan bases achieve maximum efficiency by careful attention to all these factors.

These fan bases incorporate an isolating element of new design, in an integral structure of rails and motor base to fit your exact needs. They are manufactured to your own specifications, custom-built to bring you full satisfaction in actual performance. Write to us today, or get in touch with our nearest representative, so that we may place our experience at your service.

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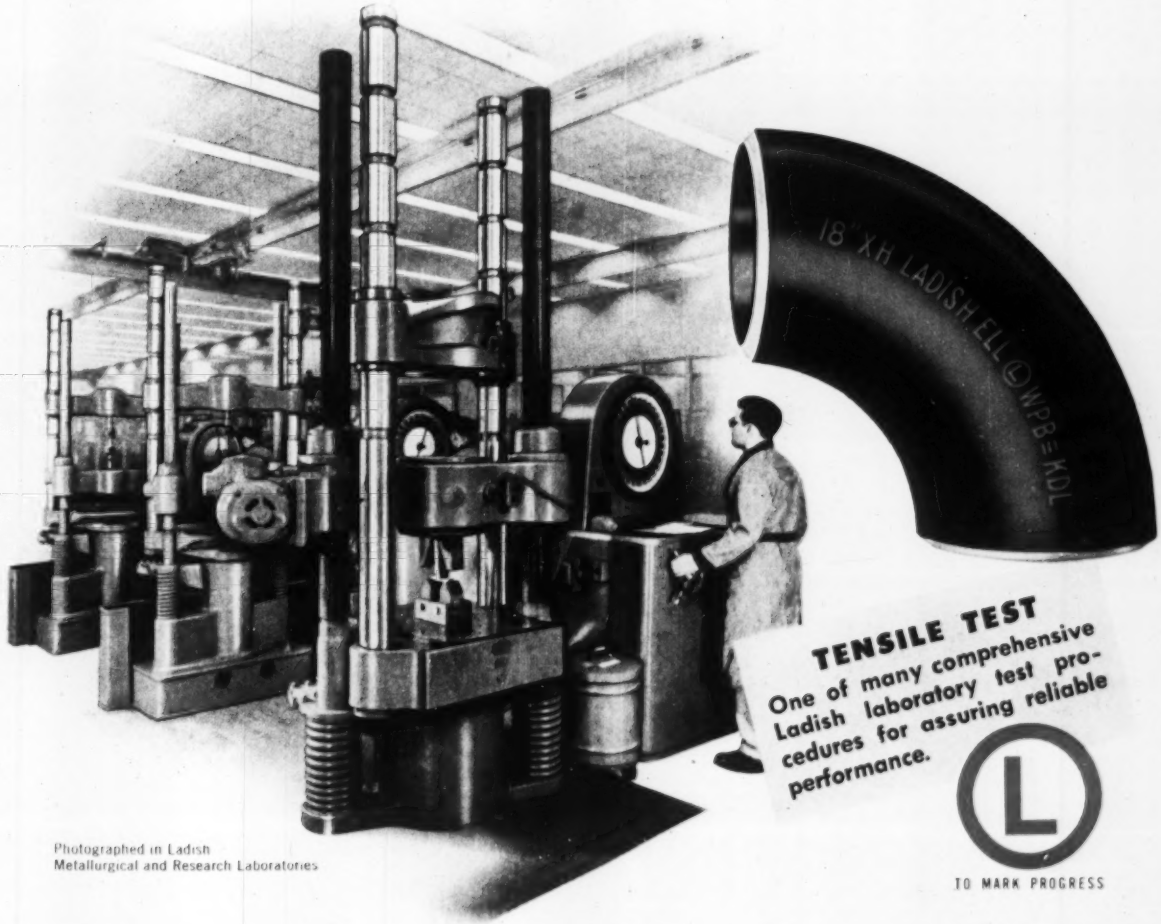

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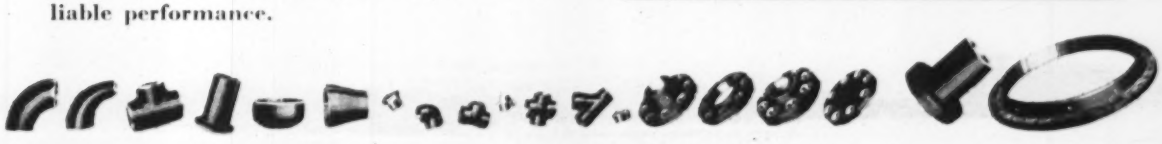

1 Self-oiling composition bushing feeds oil to shaft by capillary action.

2 Bushing has shoulder which provides self-lubricating bearing surface for collar.

3 Slotted Bolt Holes. Rubber grommets can be used for sound isolation.

4 Absorbent filler holds oil in reservoir and prevents over-lubrication.

5 Split Pressed Steel Housing is light and strong.

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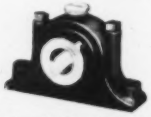

Dodge-Timken Bearings

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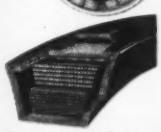

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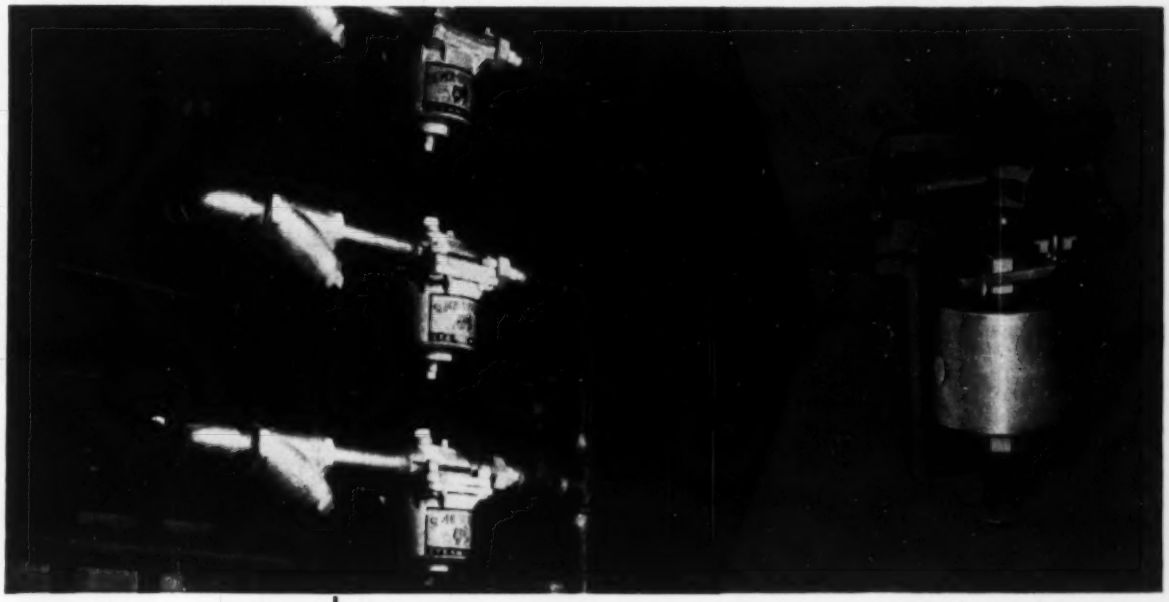
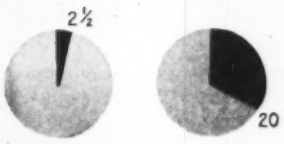
in steam traps, too!





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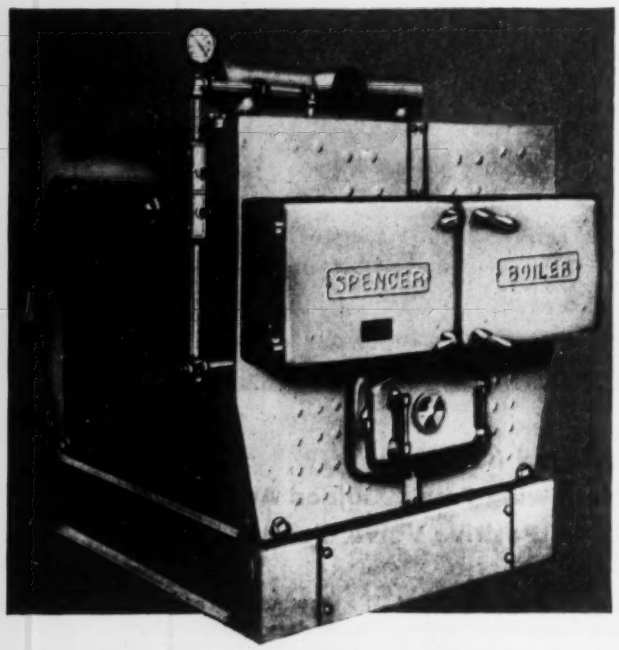
NEW DIVIDED LOW-WATERLINE BOILER

Solve Your Heating Problems



Available in a range of sizes from 3,500 to 42,500 sq. ft. steam. Working pressures: 15 lbs. steam, 30-100 lbs. water.

FOR NEW BUILDINGS

Flattened out to beat low-headroom and excavation problems. Overall height is approximately 25% less than conventional firebox boilers.

Low stack designs possible because all sizes are designed to be installed with induced draft fans.

Quiet—burns fuels more completely because all sizes contain extra-high fireboxes.

FOR EXISTING BUILDINGS

Divided in half for easier entrance through narrow basement openings. Yet two watertight sections require no welding for installation.

Easier to install because of specially designed smokebox.

FOR ALL BUILDINGS

Quickly converted from mechanical to hand-firing whenever desired, at a minimum of expense and without disturbing boiler-settings.

Service-water heating coils sized to meet all requirements including shower and cafeteria needs in schools. Both instantaneous and tank-type coils available.

FOR ADDITIONAL INFORMATION, write for our special folder on the Low-Waterline Boiler.

THERE IS A SPENCER FOR EVERY BUILDING . . . FOR EVERY FUEL

Designed, constructed and stamped in accordance with requirements of the ASME Boiler Construction Code.

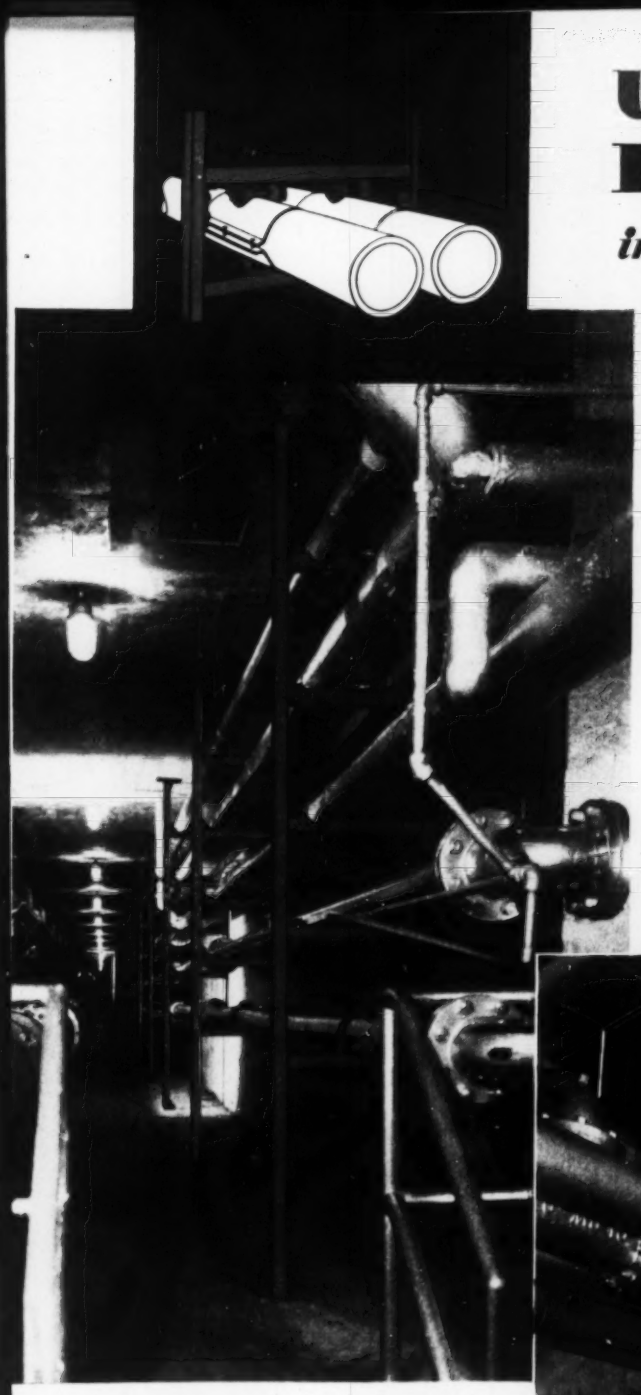
Rated in accordance with SBI Code.

Inspected and approved by licensed National Board Insurance Inspector.

SPENCER
HEATER
LYCOMING-SPENCER DIVISION
WILLIAMSPORT PENNSYLVANIA

UNISTRUT® *Simplifies* PIPE RACKING *in New Sewage Treatment Plant*

Adjustable Metal Framing supports long, heavy lines—assures exact slope, permits changes or additions at any time.



Conserves Steel, Reduces Manpower Hours, Cuts Over-all Costs

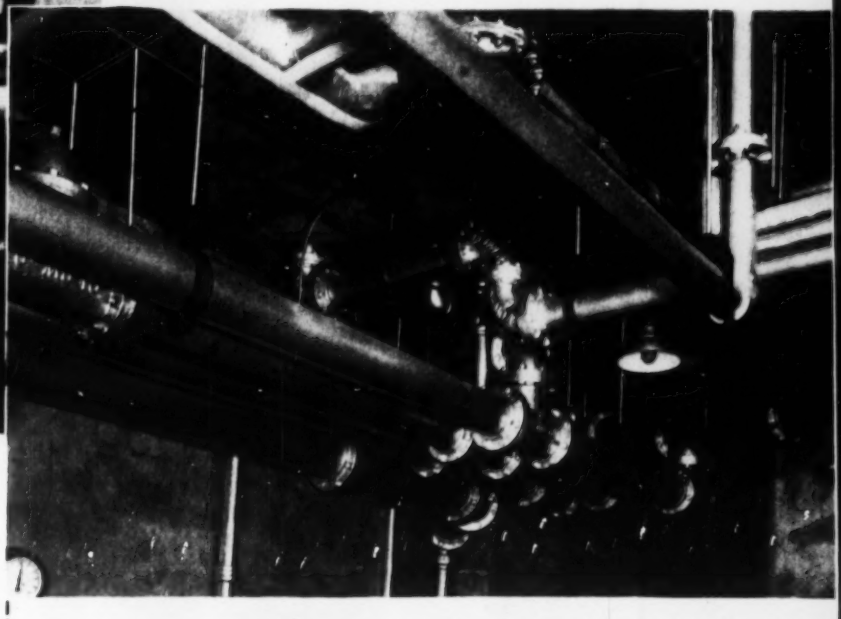
Thousands of feet of piping and conduit were racked with UNISTRUT steel channel and fittings in the new Joint Sewage Treatment Plant serving the twin Michigan cities of Benton Harbor and St. Joseph. In one small area alone, over 20 tons of overhead piping were supported by UNISTRUT concrete inserts and pipe hangers.

The UNISTRUT framing system consists of steel channel members, concrete inserts, pipe rollers, brackets, clamps and fittings which are bolted together to form a trim framework of mechanical supports.

Completely adjustable, to assure exact pitch and permit changes and additions at any time, the system eliminates much engineering detailing and all special erection equipment. Assembly is accomplished with just a saw and wrench—no drilling or welding required. Try UNISTRUT framing on your next piping job!

Water, gas, air and sludge lines racked on UNISTRUT stanchions. Concrete inserts have slot with sliding nut so fittings can be bolted in position desired.

Part of large overhead piping installation where over 20 tons of lines are suspended by UNISTRUT concrete inserts and pipe hangers.



U. S. Patent Numbers
2327587 2363382 2405631
2329815 2380379 2541908
2345650 Other Patents Pending

Distributors and Warehouse Stocks in Principal Cities. Consult your Telephone Directories.

UNISTRUT®

The World's Most Flexible All-Purpose Metal Framing

See complete catalog in Sweets 1953 Architectural, Plant Engineering and Industrial Construction Files

Write for 84-page Pocket Catalog No. 800.

For the Man on the Job! Photos, drawings, ideas and data on how to mount, hang, frame and rack all kinds of mechanical and electrical equipment.

UNISTRUT PRODUCTS COMPANY
1013 W. Washington Blvd., Chicago 7, Ill. **Dept. H11**

Please send me a copy of Pocket Catalog No. 800 without ob..gation.

Name _____

Company _____

Address _____

City _____ **Zone** _____ **State** _____

BUILT TO MEET MODERN INDUSTRIAL REQUIREMENTS

For Continuous Heat Service up to 150 Pounds Steam Pressure

Horizontal Type

Ceiling suspension type with heavy duty welded steel fin-and-tube heating element. The rugged arc-welded construction outperforms and outlasts heating elements made of thinner non-ferrous metals. Avoids their expansion-contraction faults, yet has the same BTU efficiency. Ten basic sizes with capacities from 30 Mbh to 490 Mbh. Totally enclosed motors. (Extra heavy non-ferrous coils also available.)

Vertical Projection Type Also Available

For efficient heating from high-ceiling areas—for door heaters over small openings—or where the horizontal type is not applicable. Ten basic sizes; capacities from 27 to 332 Mbh.

Write for Bulletins

No. 513 Horizontal Type

No. 516 Vertical Type

IUHA HEAT WITH UNIT HEATERS

SEE OUR CATALOG IN SWEET'S

CERTIFIED RATINGS

All New York Blower Company products are laboratory tested, accurately rated and fully guaranteed in strict accordance with Standard Test Codes.

THE NEW YORK BLOWER COMPANY

SALES OFFICES • 3159 SOUTH SHIELDS AVENUE • CHICAGO 16

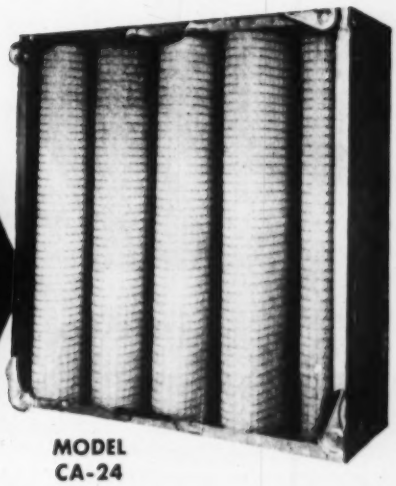
FACTORY, LAPORTE, INDIANA

ANNOUNCING

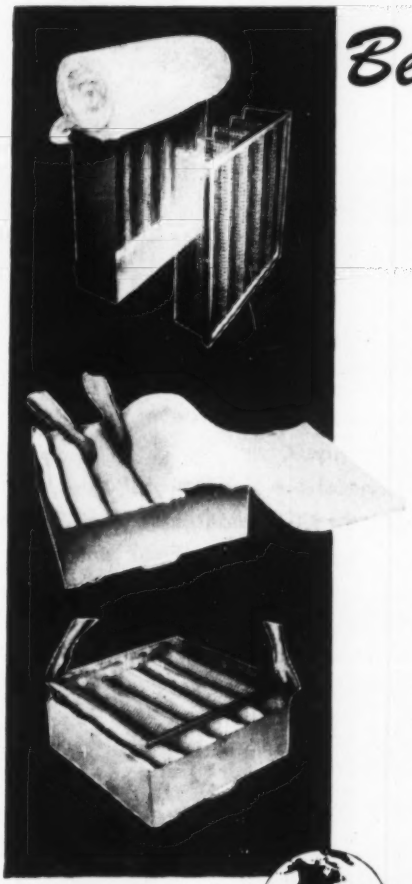
NEW... DIFFERENT

DYCON

DRY AIR FILTER



MODEL
CA-24



Beats all for: ECONOMY
EFFICIENCY
MINIMUM MAINTENANCE

Vacuum it! Wash it!

At last, here's a different kind of dry air filter with high efficiency, large dust-holding capacity, and low maintenance factor. The virtually permanent Dycon filter media — consisting of a thick blanket of specially prepared synthetic fibers — has approximately 4 times the dust-holding capacity of other widely-used dry air filters of similar size and efficiency.

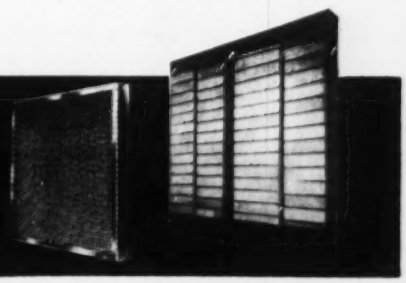
When finally dust-laden, Continental's CA-24 Dycon filter can be restored quickly to like-new efficiency by vacuum cleaning, or washing with a cold water hose. No oil is involved.

Write today for more detailed information — ask for Bulletin 501-A.

CONTINENTAL

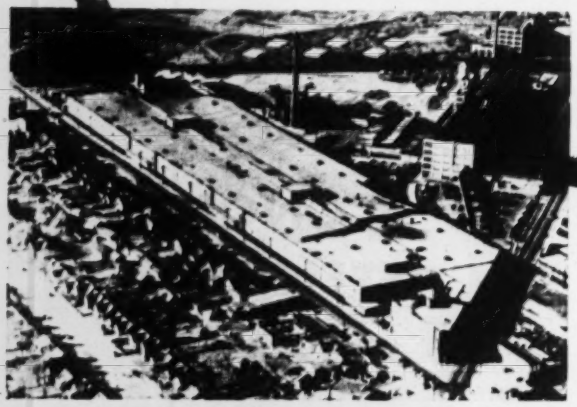
P.O. BOX 1647 LOUISVILLE 1, KY.

CONTINENTAL AIR FILTERS Inc.



7 DETROIT STOKERS

in two *Eli Lilly and Company plants*

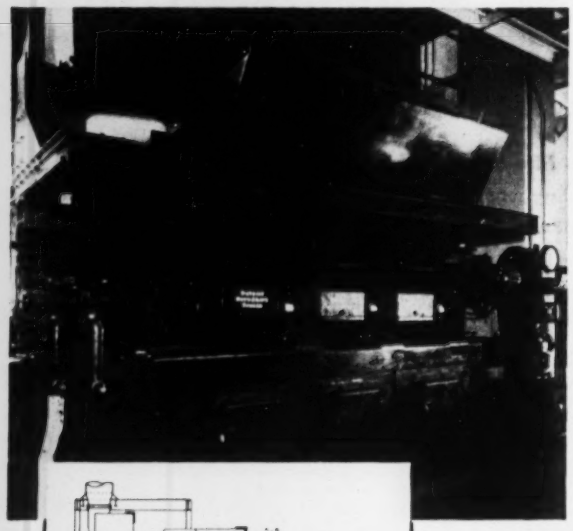


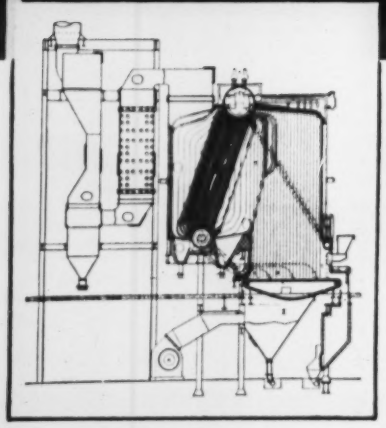
FOUR CONTRACTS

High efficiency with low maintenance—ability to handle rapidly fluctuating loads, and cleanliness are Detroit Stoker features that appealed to Eli Lilly and Company engineers.

Cleanliness—elimination of sources of possible contamination—is of paramount importance to plants making thousands of medicinal products having the highest reputation for purity.

At the left one of the two Detroit Roto-Grate Stokers at the Lilly Indianapolis plant. Capacity each Babcock and Wilcox unit 75,000 pounds per hour. RotoGrates also are in service at their new Tippecanoe Laboratories, Lafayette, Indiana.





Write for Catalog—No Obligation.

DETROIT SINCE 1898 STOKERS

DETROIT STOKER COMPANY

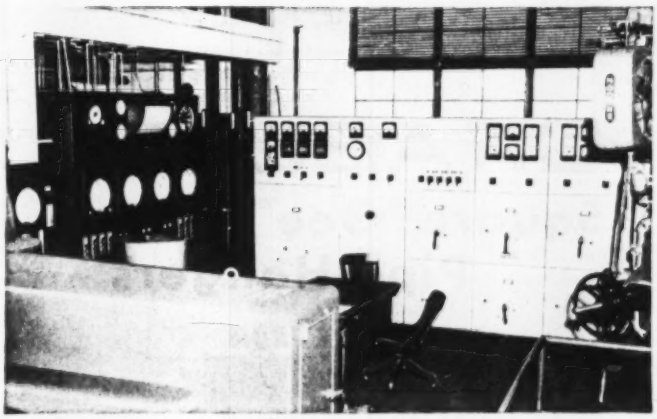
GENERAL MOTORS BLDG., DETROIT 2, MICH.

District offices in Principal Cities • Works in Monroe, Mich.

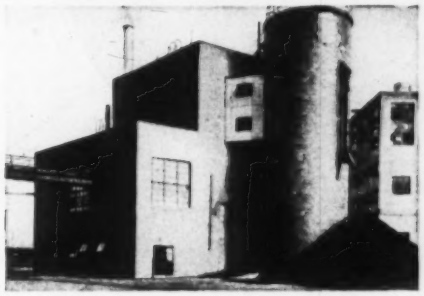
Quaker Oats
REDUCES STEAM COSTS BY
BURNING COAL THE MODERN WAY

"Our new coal installation produces steam at a cost of 32¢ per 1000 lbs. . . . reduces some operating costs about one half,"

says Walter H. Proescholdt
Asst. Chief Engineer
The Quaker Oats Company



Control center for combined boiler and turbine room operations at Quaker Oats' modern, new plant



To gain economy plus dependability, Quaker Oats Company modernized the boiler room in its paper-making plant. One efficient, coal-fired unit now supplies all steam needed for heating, processing, and power generation.

Boiler and turbine room operations combined. With automatic controls and coal- and ash-handling systems, two men per shift can operate the combination boiler and turbine generator room shown at left. Quaker Oats has found that burning coal the modern way certainly increases efficiency of operation and cuts operating costs.

Additional case histories, showing how plants of other types have saved money by burning coal the modern way, are available upon request.

Many power plants over ten years old are as dated in efficiency as the automobiles of the same period. Ton for ton, coal burned in a modern plant can produce 10% to 40% more power. Modern coal- and ash-handling equipment can also cut labor costs substantially.

Why not let a consulting engineer look over your plant? Chances are he can point out ways of remodeling so that you can burn bituminous coal the modern way . . . and save dollars.

It pays to burn coal efficiently, because coal is not only an economical, but a dependable fuel. Coal reserves are virtually unlimited. America's coal industry is the world's most efficient and progressive. Thus you're assured of a plentiful supply of coal at relatively stable prices for generations.

If you operate a steam plant, you can't afford to ignore these facts!

BITUMINOUS COAL in most places is today's lowest-cost fuel, and coal reserves in America are adequate for *hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
Southern Building, Washington 5, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

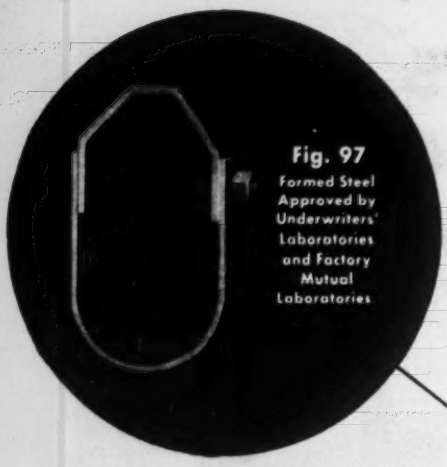


Fig. 97
Formed Steel Approved by Underwriters' Laboratories and Factory Mutual Laboratories

Fig. 352
Malleable Iron Approved by Underwriters' Laboratories and Factory Mutual Laboratories.

Fig. 392
Malleable Iron Adjustable, I Beam Flange.

DOUBLE CHECK
the time cost of assembling pipe hangers with the pipe.

Fig. 315
Malleable Iron Approved by Underwriters' Laboratories and Factory Mutual Laboratories.

GRABLER
Square "Gee" Pipe Hangers

GIVE RELIEF FROM TIME-WASTING GRIEF

Fig. 317
Malleable Iron

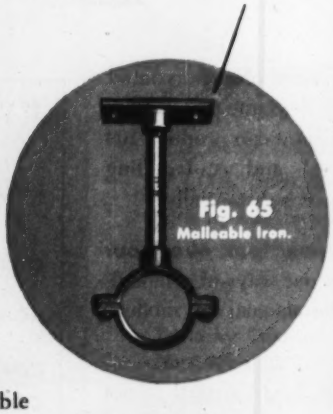


Fig. 65
Malleable Iron.

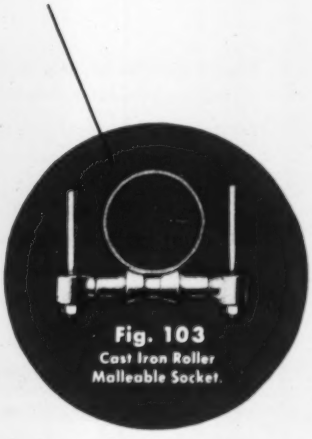


Fig. 103
Cast Iron Roller Malleable Socket.

Pipe hangers can be time-cost saving tools! A double check of time-cost records where Square "Gee" Pipe Hangers were used will reveal time-cost savings. Designed and fabricated to comply with modern engineering and construction practices, Grabler Square "Gee" Pipe Hangers truly give relief from time-wasting grief. Grabler Pipe Hanger Catalog J illustrates and lists many types. Ask your wholesaler for Grabler Square "Gee" Pipe Hangers.

THE SQUARE "GEE" LINE INCLUDES:
Malleable Fittings, AAR Fittings, Unions, Rail Fittings, Cast Iron Steam Fittings, Cast Iron Drainage Fittings, Patented Drainage Fittings, Copper Tube Solder-Joint Fittings, Cast Brass Solder-Joint Drainage Fittings, Steel Pipe Nipples, Hangers.

THE GRABLER MANUFACTURING COMPANY • 6565 BROADWAY, CLEVELAND 5, OHIO

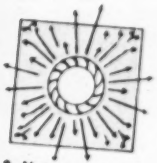
WAREHOUSES: New York • Philadelphia • Atlanta • Pittsburgh • New Orleans • Dallas • Chicago • St. Louis • Minneapolis • Denver • San Francisco • Los Angeles

as an engineer which power roof exhauster design would you say—

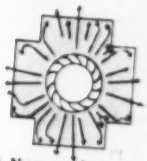
is more efficient?

Cross Sections: Discharge cones

1. Uniform unobstructed circumferential discharge



2. Non-uniform obstructed discharge



3. Non-uniform obstructed discharge

It is obvious that No. 1 because of its unobstructed discharge is more efficient. The corners of Numbers 2 and 3 create obstruction to the free flow of air and develop turbulence.

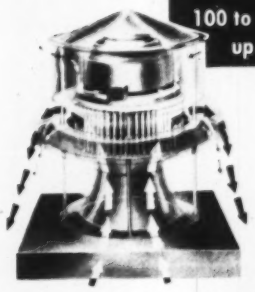
1. Built-in scroll design with ability to develop high static pressures

2. Little if any scroll effect and incapable of developing high static pressures

3. Similar typical design with little or no ability to develop high static pressures

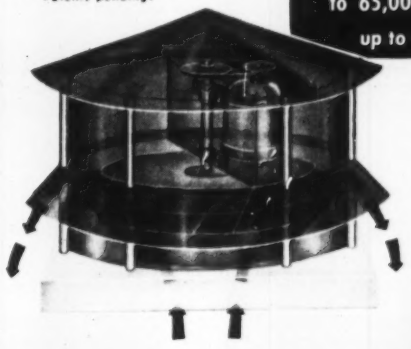
The high static pressures scroll design of No. 1 is a must for efficiency. In this design a portion of the high velocity pressure at the blade exits is converted to static pressure. Other designs are merely free air machines.

Direct Drive
100 to 11,000 CFM
up to 4.2" S.P.



Patents 2188741 2526290.
Patents pending.

NEW Belt Drive 4000 to 65,000 CFM up to 4" S.P.



Both No. 1's are features of the Gallaher Air-Van. The scroll effect design is a patented exclusive feature. It is the reason why only Gallaher power roof exhausters are able to handle almost every industrial ventilation problem that demands moving large volumes of air when high slot velocities must be maintained.

Gallaher power roof exhausters design is based on fundamental research and their true efficiency is based on actual physical tests of the entire unit, by an independent laboratory under the direction of a nationally recognized authority.

Check with your Gallaher representative or write to Department HN.

The GALLAHER Company
4108 DODGE STREET OMAHA, NEBRASKA

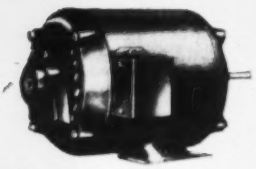
for smooth,
quiet performance
that keeps customers happy

standardize on Century MOTORS

SINGLE PHASE:

Split Phase Induction—⅛, ¼, ⅓, H.P.
Capacitor—⅛ to 20 H.P.
Repulsion start, brush lifting,
Induction—½, to 7½ H.P.

For unit heaters, attic fans, furnace blowers, window fans, room coolers, circulating pumps, compressors.



of Types and Sizes For All Your Needs

POLYPHASE:

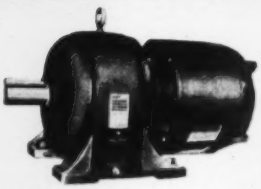
Squirrel Cage Induction—⅛ to 400 H.P.
Wound Rotor Motors—1 to 400 H.P.
Synchronous Motors—20 to 150 H.P.

For compressors, fans, blowers, cooling towers, pumps.

DIRECT CURRENT:

⅛ to 300 H.P.

For all applications that require direct current.



GEAR MOTORS:

⅛ to 15 H.P., single, double and triple gear reduction.

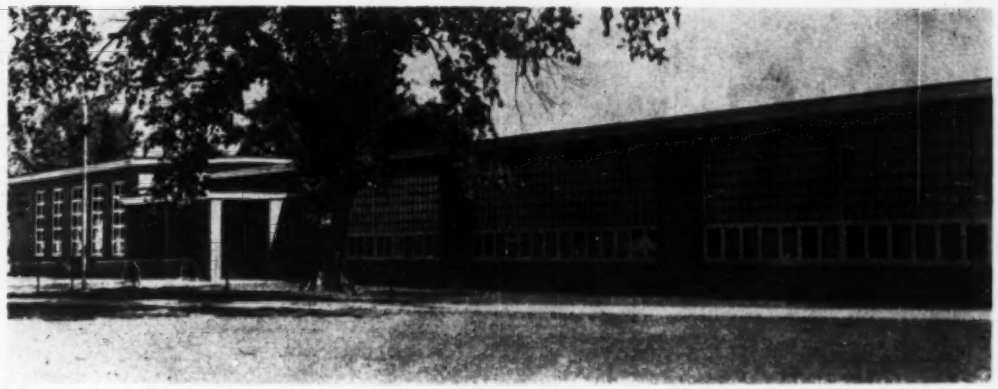
Century C MOTORS

CENTURY ELECTRIC COMPANY

1809 PINE STREET • ST. LOUIS 3, MISSOURI

Offices and Stock Points In Principal Cities

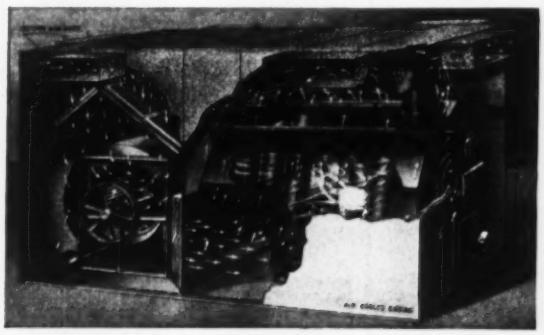
WARM AIR HEATED... by Campbell



Pella Christian School, Pella, Iowa. This one-story school covering over 14,000 sq. ft. is heated by a Campbell 8000 combination gas-oil unit with a Campbell PerimetAir Distribution system. Architect, James K. Haveman, Grand Rapids, Mich.

OUTSTANDING SCHOOL INSTALLATION

Warm air heating of large multi-room buildings is both practical and economical when you specify a Campbell 8000 Heater. The outstanding efficiency of these Campbell Heaters assures quick, abundant heat with exceptional fuel economy. Designed for easy installation. Campbell Warm Air Heating Engineers will welcome the opportunity to figure with you on your next large heating job.

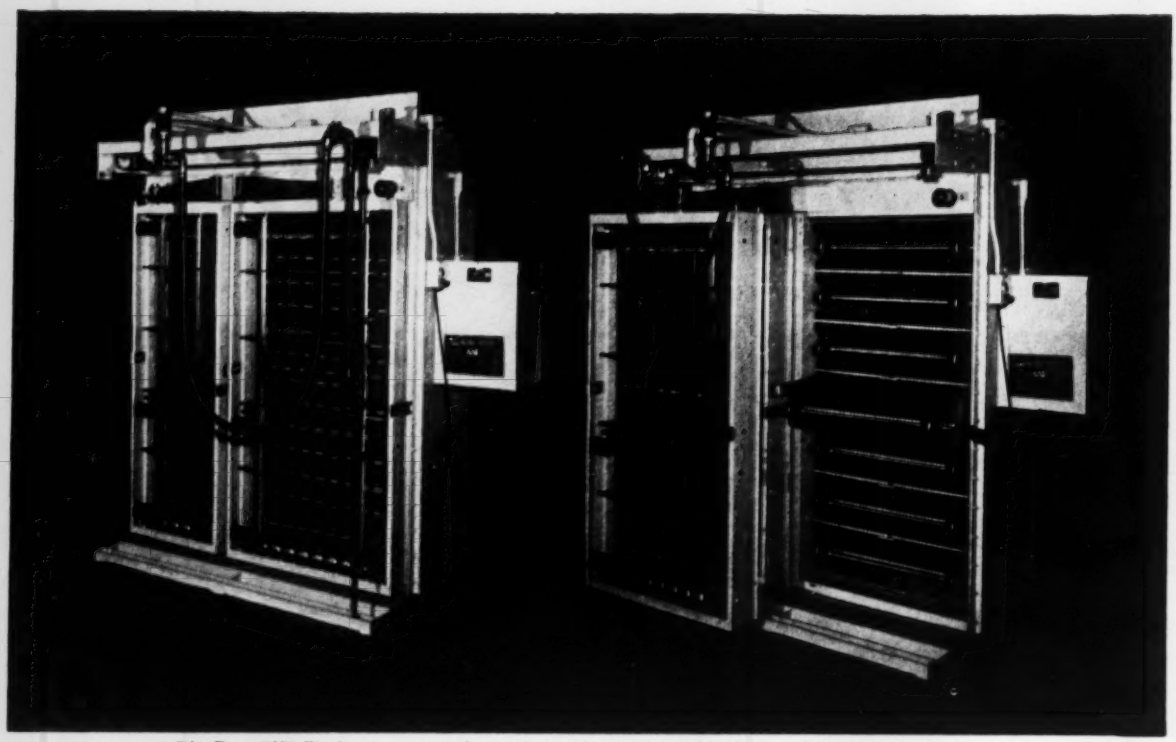


MANUFACTURERS' AGENTS

We have a number of attractive openings for manufacturers' agents who call on heating contractors and architects. If interested, please state territory you cover.

CAMPBELL HEATING CO.
Des Moines 17, Iowa
I am interested in your proposition for manufacturers' agents.
My territory covers.....
NAME.....
ADDRESS.....
CITY.....ZONE.....STATE.....

CAMPBELL HEATING COMPANY
Des Moines 17, Iowa



The Type "H" Washer incorporated as an integral part of an ELECTRO-CELL precipitator provides "push button" control of the cleaning operation. The washer travels on an overhead trackway which keeps it operating freely. The vertical header carrying the spray nozzle is rotated at each end of the travel to provide the necessary 5 degree lead to assure thorough cleaning of the plates. RIGHT: Shows how the hinged ionizers can be opened freely to permit removal or inspection of the plate cells.

ANNOUNCING THE **NEW** ELECTRO-CELL TYPE "H" WASHER
with push button control

Here's another *first* from the engineering department of American Air Filter Company. The new Type "H" Washer on the famous ELECTRO-CELL precipitator is a major contribution to the field of electronic air cleaning equipment—another important reason for AAF leadership!

Fully automatic, the spray head moves back and forth across the face of the removable plate cells. Accumulated dirt and dust is washed away—maintaining the high cleaning efficiency of the ELECTRO-CELL . . . which provides super clean air for many critical industrial and commercial uses.

The new Type "H" Washer has many advantages including its nominal cost. It in no way interferes with the opening of the hinged Ionizers or removing the plate cells.

Another exclusive feature of the new Type "H" Washer is the positioning of the spray-heads. These are automatically adjusted to always point at a 5 degree angle in the direction the spray-heads are travelling. This insures thorough washing action over the entire depth and each side of each individual plate.

The water used by the sprayer is controlled by a solenoid valve connected with the spray-head motor drive and is synchronized with the travelling spray-heads.

The ELECTRO-CELL, long famous in the field of electronic air cleaning, removes dust, dirt and even smoke from the air. With the addition of the Type "H" Washer it is even more efficient and practical to operate . . . and maintenance is reduced to a minimum!

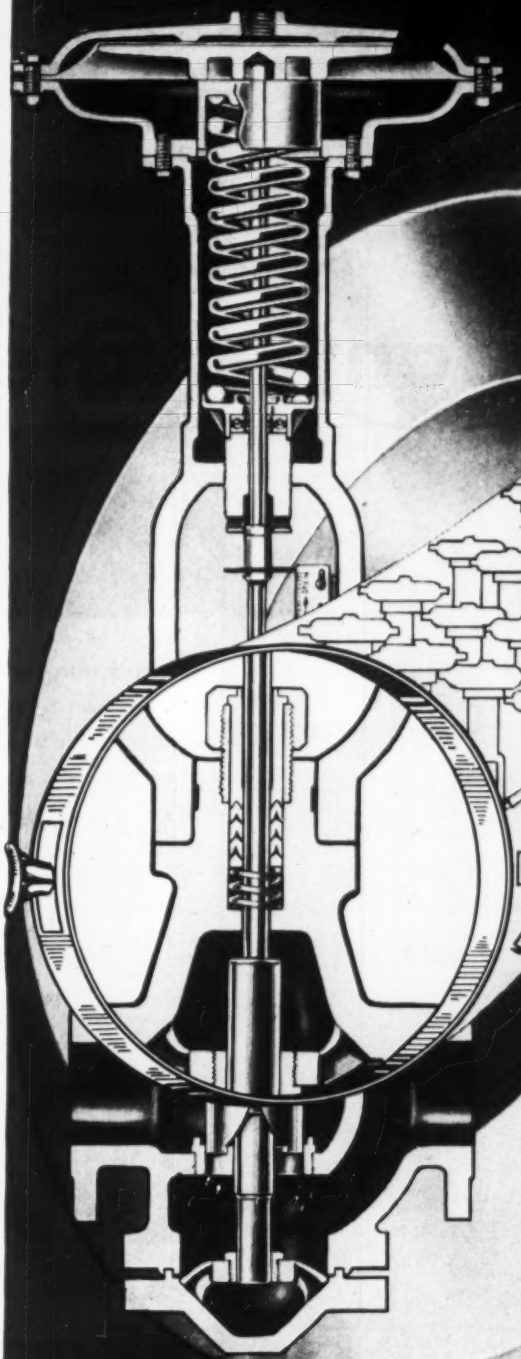
Write the American Air Filter Company for technical data and descriptive information on this latest AAF achievement. AAF experience will help you solve all of your air cleaning problems.

expect the best from . . . . . AAF

American Air Filter
COMPANY, INC.
373 Central Avenue • Louisville 8, Kentucky

FISHER®

V-RING PACKING



. . . LEADING THE MARCH TO BETTER DIAPHRAGM MOTOR VALVE PERFORMANCE

roved by many months of field service
Fisher Teflon V-Ring Packing feature

- No gland leakage.
- Used on wide range of pressures w
out appreciable change in friction va
- Elimination of maintenance an
adjustment.
- No valve stem lubricators r
- Chemically inert to all fluid
450° F.

Fisher Teflon V-Ring Packing is now
all Fisher Diaphragm Motor Valve

Bulletin E-200 giv

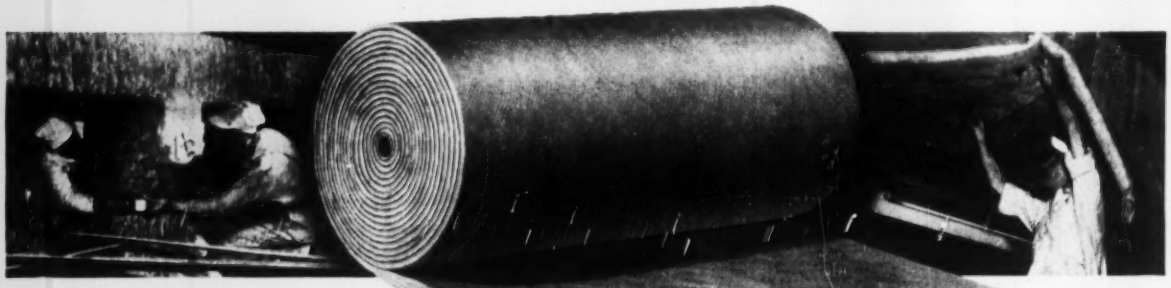
*Teflon is the trade name

NOR COMPANY

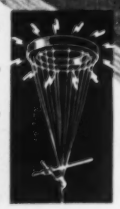
MICROLITE fits any shape

The fact that ducts come in assorted shapes and sizes is what endears Microlite glass fiber insulating wool to the guys on the job. Microlite is so soft and compressible and lightweight it can be wrapped easily around any shape or system—in the hardest-to-get-to locations. Clings like the proverbial vine. Is so tough it doesn't have to be babied. Doesn't itch. Cuts easily with knife or scissors. Can be quickly fastened by adhesion or stapling. And on top of all that, inch for inch Microlite is one of the most effective of all insulating materials from sub-zero to 400° F. For folder and samples write to Glass Fibers Inc., 1810 Madison Avenue, Toledo 2, Ohio.

MICROLITE *is an excellent absorber of sound* • **MICROLITE** *is inorganic, resists fire and moisture*
MICROLITE *is fungus-and-bacteria proof* • **MICROLITE** *is shipped in space-saving rolls compressed 4-to-1*



VITRON Glass Textile Yarns • Rovings • Micro-Fibers
DURAMAT Vapor Barriers • **BLUE FLAG** Pipe Wrap
MICROLITE Thermal and Acoustical Insulation
VIBRAGLASS Mounting and Packaging Materials
COUSTIC-AIRE and **THERMO-JET** Aircraft Insulations



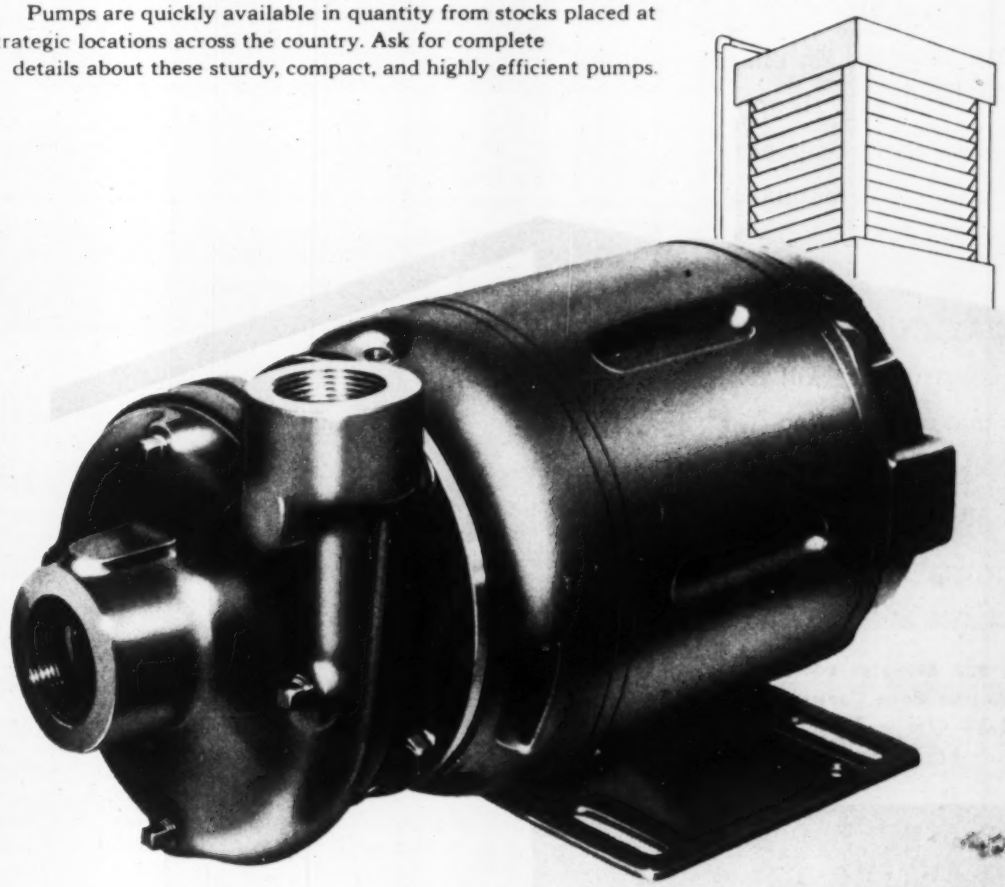
GLASS FIBERS *INC.*

Makers of glass fibers by the ELECTRONIC–EXTRUSION process ... developed, patented and used exclusively by Glass Fibers Inc.

*A **quick** source of reliable*

Air Conditioning and Refrigeration Pumps

For circulating water through cooling towers and evaporative coolers, Marlow offers a wide range of exceptionally dependable pumps designed specifically for this service. Although ruggedly constructed, these pumps are compact and easily installed in cramped quarters, in any position, at any angle. Over a quarter century's specialized pump experience insures peak performance and longest service life. Marlow Pumps are quickly available in quantity from stocks placed at strategic locations across the country. Ask for complete details about these sturdy, compact, and highly efficient pumps.



World's largest manufacturer of self-priming centrifugal, diaphragm and plunger pumps . . .

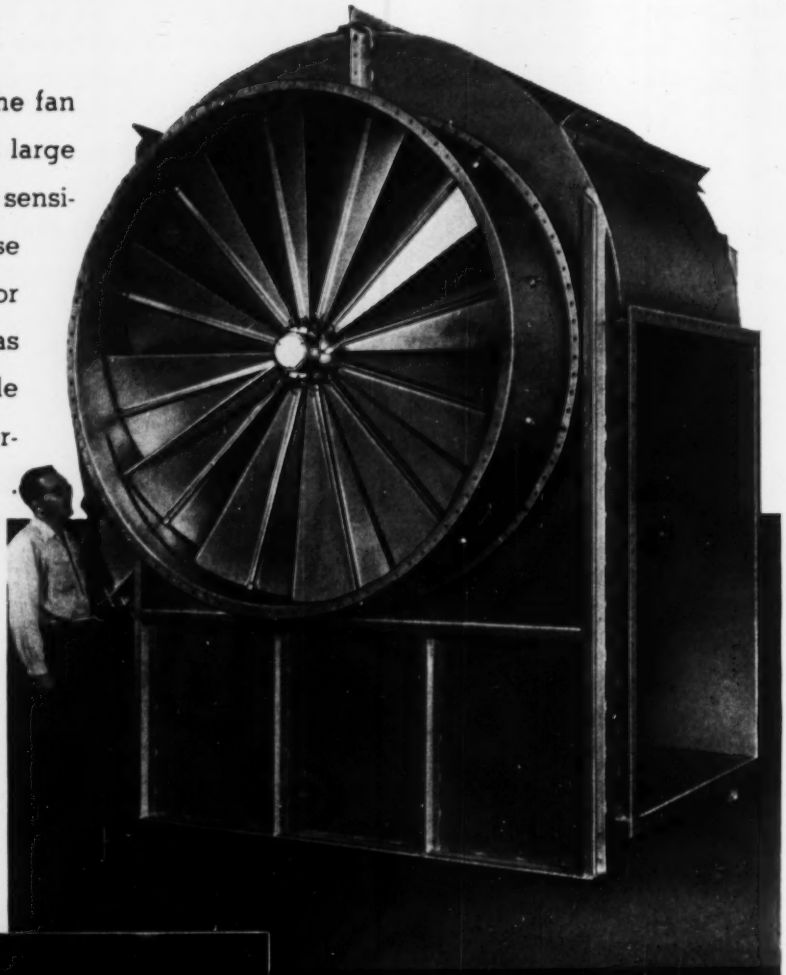
Marlow Pumps

Ridgewood, New Jersey • Branch Plant — De Queen, Arkansas

Other factories in France and England. Distributors and dealers everywhere.

For PRECISION CONTROLLED FAN Performance...

. . . perfect co-ordination of the fan operation is essential. In this large vane-controlled unit, high sensitivity is the key to both ease and dependability in manual or automatic control. It serves as a typical example of the wide scope of BAYLEY fan engineering and construction skill . . . Facilities that can be effectively applied to *your* air handling problems.



No. 807 Aeroplex Kiln Fan With Inlet Vane Control — 125,000 CFM — 7" S.P.

Bayley

BLOWER COMPANY

6600 W. Burnham Street • Milwaukee 14, Wis.

SR—40

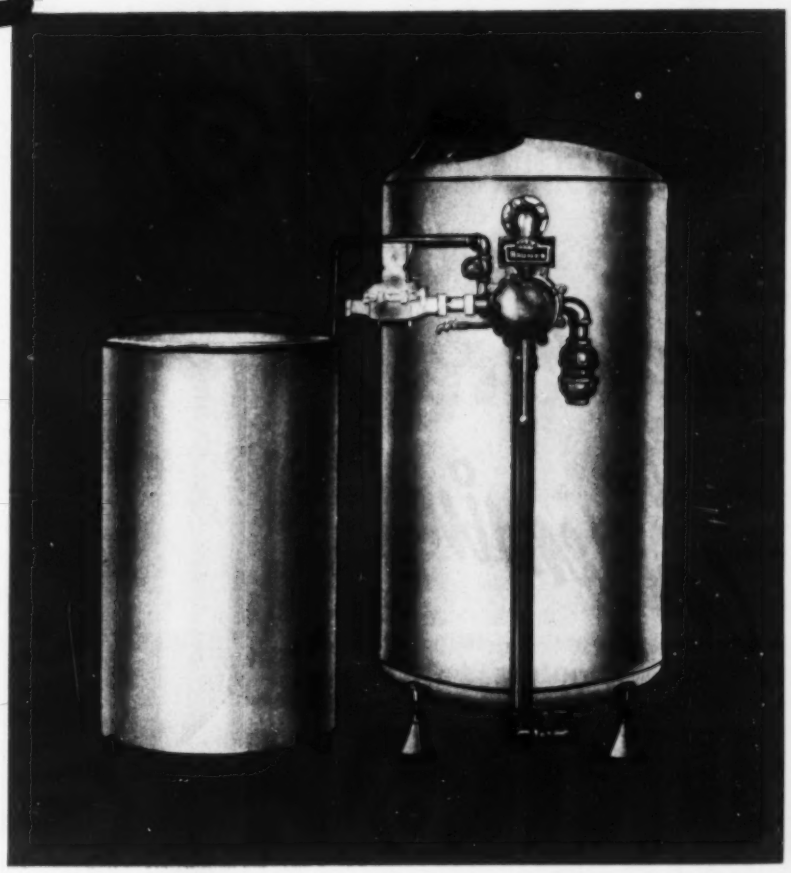
BRUNER
WATER SOFTENERS & FILTERS

WATER SOFTENERS
FOR INDUSTRY

Some recent installations of BRUNER industrial equipment:

- Flint, Michigan — Chevrolet Division, General Motors
- Amarillo, Texas — Pantax Ordnance
- New Orleans, La. — Jung Hotel
- Peoria, Ill.—Methodist Hospital
- Jacksonville, Florida — Jacksonville Power Plant #2
- Lansing, Mich. — Michigan State College
- Exeter, Calif. — Exeter Memorial Hospital

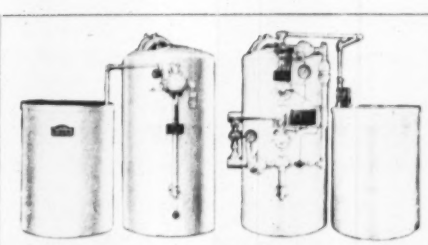
Hundreds of other huge installations of BRUNER softeners and filters from coast to coast and from border to border include almost every state in the Union.



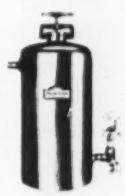
These new improved single units now available from stock, deliver 1,200,000 GR capacity with flow rate up to 150 GPM.

Twin units provide double capacity at twice the flow rate. Special units with up to 10,000,000 GR capacity at 800 gallons per minute can be supplied.

Bruner exclusive type automatic backwash control has no moving parts, guarantees no loss of mineral at high pressures yet assures positive cleaning of mineral bed at low pressures.
Dowex Lifetime Mineral is supplied as standard. Green sand or synthetic zeolite can be furnished. Your inquiry will receive prompt attention.



Dial-O-Matic and Solo Valve Heavy-duty models 80 to 160 GPM — 600,000 to 1,200,000 GR carried in stock.



Brucex Feeder for corrosion control.

"America's Most Complete Line of Quality Water Softeners and Filters".

Offices in principal cities.

West Coast Plant and Office —
339 Indiana Street, El Segundo, Calif.

BRUNER CORPORATION • 2318 North 30th Street
MILWAUKEE 45, WISCONSIN

PHOTO OF UNICON INSTALLATION
AT SHOYER'S RESTAURANT, PHILA., PA.
BY ATLANTIC REFRIGERATION AND EQUIPMENT CO.,
PHILA., PA.

No Water needed for Condensing

WITH THE

UNICON

TRADE MARK

by KRAMER

Any Size compressor REGARDLESS OF TONNAGE can be Air-Cooled with UNICON

If water is a problem,
there is only one CORRECT SOLUTION—
UNICON by Kramer,
the air-cooled condenser that DOES NOT USE WATER!

Two types—the direct drive and the belt drive—are available for ¾ to 100 H.P.

Stands, hoods, and wind deflectors are available for simplified mounting. You need nothing else!

WRITE FOR BULLETIN U-210

KRAMER TRENTON CO. • Trenton 5, N.J.

Now ready for you...

Advance personal edition KEWANEE General Catalog 80

There's a new copy of the advance Personal Edition Kewanee General Catalog 80 waiting for you.

Here is the latest most authentic and complete data and dimensions on the entire Kewanee line.

You most likely need the material in this 32-page fully illustrated technical catalog now to help you select the proper boilers and accessories for jobs that are coming up.

The catalog is written especially for you and can be used as an authentic technical reference source. It is your own personal edition available in advance of Sweets and Domestic Engineering catalogs for 1954.

The catalog will contain full description of such products as...

1. *High and low pressure commercial and industrial boilers*
2. *Residential Boilers*
3. *Water Heating Equipment*
   - *(a) Direct fired types*
   - *(b) Storage types*
   - *(c) Indirect water heating coils for Kewanee Boilers*
4. *Boiler support brackets and structural steel suspension for Kewanee Boilers.*
5. *Induced draft fans for Kewanee Boilers*

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AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS
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Paul C. Reilly, Architect Sears & Kopf, Consult. Engrs. Frank A. McBride Co., Heating Contractors

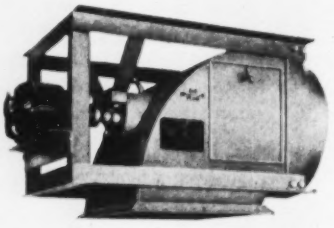
Newark's Cathedral of the Sacred Heart

One of the World's Great Cathedrals is equipped with WING DRAFT INDUCERS

Now moving to completion after fifty years of building, this magnificent edifice combines the architectural splendor of the past with today's utilitarian advancements. An example is the up-to-the-minute equipment that comfortably heats the spacious interior.

Handling a total load of 70,000 sq. ft. EDR are three H. B. Smith gas fired boilers. Even though a chimney was provided, consulting engineers decided that proper draft and removal of waste gases required a WING Draft Inducer for each boiler. Barometric dampers with relief gates were mounted integrally on each Draft Inducer.

The positive, dependable draft, in just the right volume, created by WING Draft Inducers assures efficient combustion at all times despite weather conditions, and without the need for tall stacks. Write for a copy of Bulletin I-52.



Wing

L. J. Wing Mfg. Co.

140 Vreeland Mills Road
Linden, New Jersey

Factories at Linden, N. J. and Montreal, Canada

HEAT THAT MOVES AROUND

with the WING REVOLVING HEATER

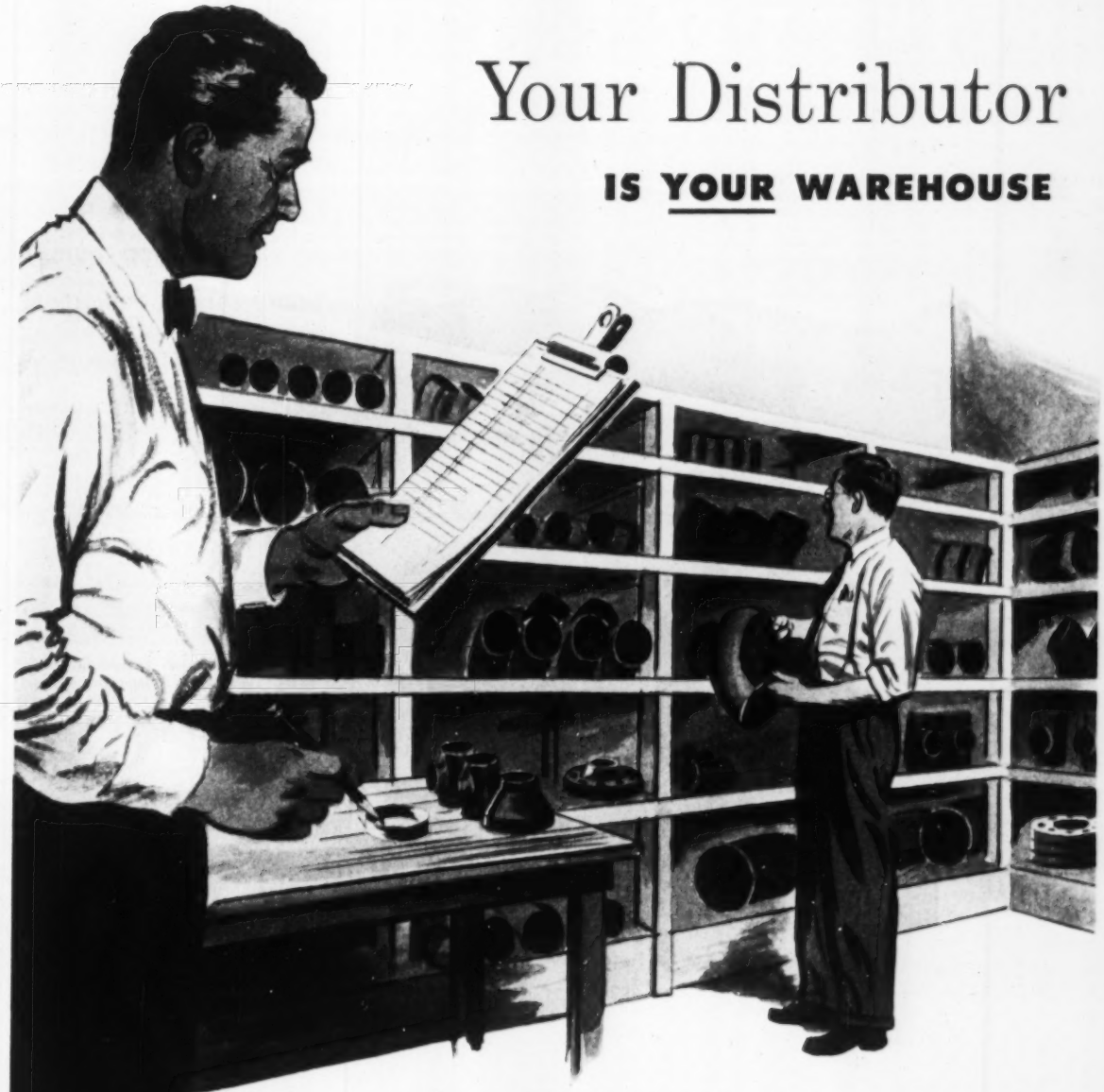
The fact that the discharge outlets of Wing Revolving Heaters keep the heated air in gentle, constant motion is the reason firms like the Budd Company have installed Wing Revolving Heaters in their plants, both at Philadelphia, and at the plant shown in the photograph above at Gary, Indiana. Big blanking and forming presses make a natural barrier to ordinary heating systems, but

not to the moving streams of heated air from the Wing Revolving Heaters, even suspended, as they must be, far above the floor to clear the cranes. Uniform distribution is accomplished because the moving streams of heated air sweep slowly around through 360 degrees, covering successively every direction; thus every part of the plant is kept at a comfortable temperature. And in Summer, with the steam turned off and fans on, the revolving discharge outlets create a sensation of pleasing coolness that is very refreshing even on the hottest days.

Write for a copy of Bulletin HR-6 to L. J. Wing Mfg. Co., 140 Vreeland Mills Road, Linden, New Jersey.

Your Distributor

IS YOUR WAREHOUSE



TUBE-TURN

"TT" and "TUBE-TURN" Reg. U.S. Pat. Off.

ONE of your TUBE TURNS' Distributor's prime functions is to maintain local stocks of equipment and supplies. In effect, he acts as your warehouse—permitting you to operate with reduced inventories, and to move quickly to meet changing production needs.

TUBE TURNS' Distributors and TUBE TURNS, INC., are a service-minded team. Call your nearby TUBE TURNS' Distributors for good service in good connections—it will help you with your inventory and supply operations.

The Leading Manufacturer of Welding Fittings and Flanges

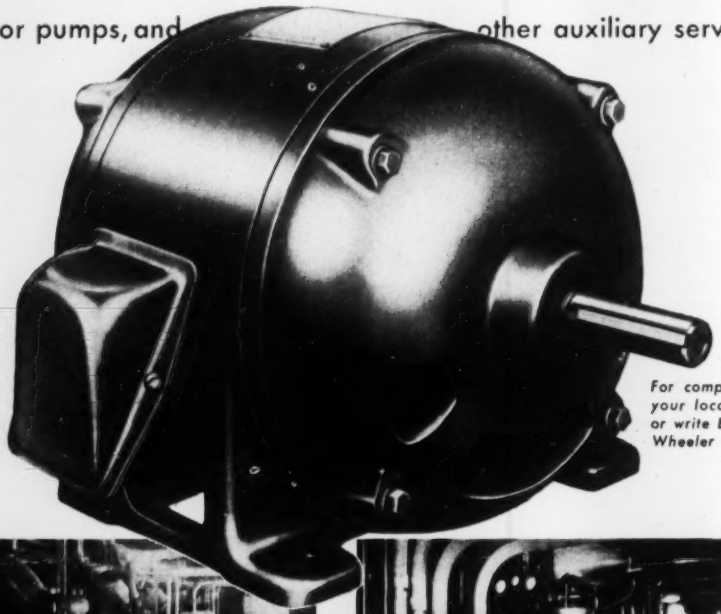
TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles • Denver • Atlanta • Dallas • Midland, Texas

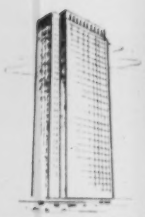
Subsidiaries: TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO • PENNSYLVANIA FORGE CORPORATION, PHILADELPHIA, PA.

Tops for air conditioning drives!

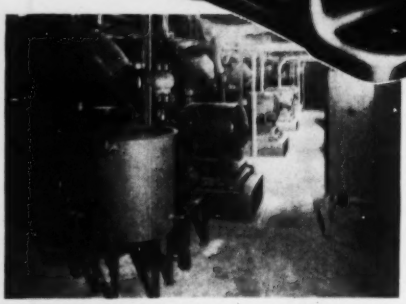
ELLIOTT CROCKER-WHEELER DRIP-PROOF MOTORS have been selected on the basis of reputation and reliability to serve many fine modern, completely air-conditioned buildings of all types. In the same buildings, in addition to air-conditioning drives, Elliott C-W motors are used in large numbers in driving fire pumps, sump pumps, fans, sewage ejector pumps, and other auxiliary service equipment.



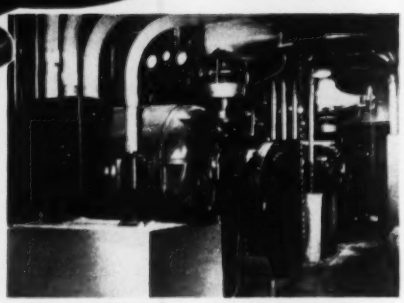
For complete information contact your local Elliott representative or write Elliott Company, Crocker-Wheeler Division, Ampere, N. J.



IN A PITTSBURGH OFFICE BUILDING



Three Elliott C-W 125-hp motors driving pumps in the refrigeration system.

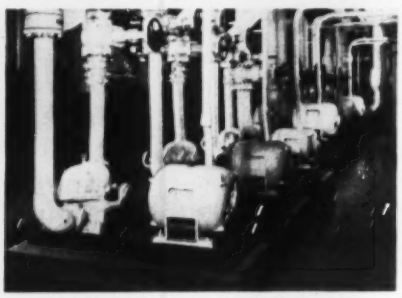


Two of three Elliott C-W 400-hp motors driving freon compressors.

IN A MID-WEST DEPARTMENT STORE

IN A FAMOUS CHICAGO HOTEL

A 40-hp 1800-rpm Elliott C-W motor driving an air conditioning unit.



Seven Elliott C-W motors (60- and 150-hp) driving pumps.

IN A NEW YORK SKYSCRAPER

ELLIOTT Company

CROCKER-WHEELER DIVISION

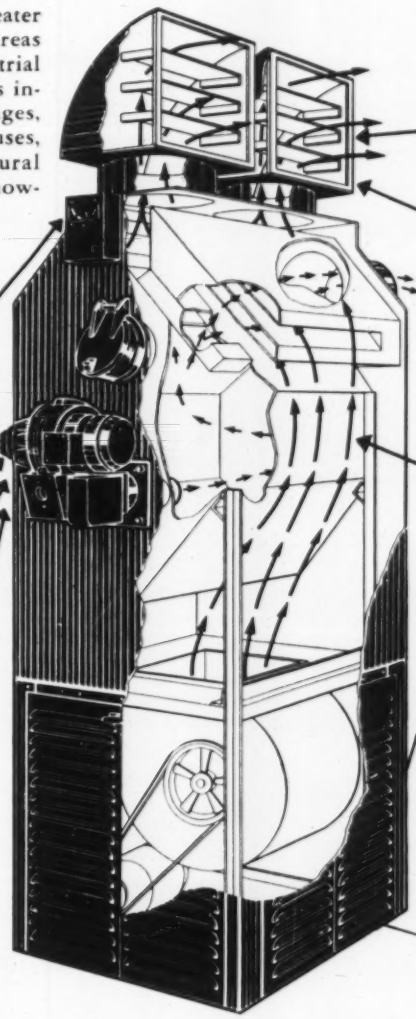
W3-7

PRESENTING THE NEW DRAVO *Paraflo* SPACE HEATER

Now available in units of 200,000 or 250,000 Btu/hr output

The new Dravo *Paraflo* Space Heater is designed for heating open areas in small commercial and industrial buildings. Typical installations include service stations and garages, construction offices, warehouses, recreation centers, agricultural buildings, stores, offices and showrooms.

Look at these features



MAXIMUM AIR THROW 90-FOOT. WITH OR WITHOUT DUCTWORK

DISCHARGE NOZZLES CAN ROTATE 360°

COMPLETELY AUTOMATICALLY AND THERMOSTATICALLY CONTROLLED— NO ATTENDANT REQUIRED

FLOATING STAINLESS-STEEL COMBUSTION CHAMBER ELIMINATES REFRACTORY LINING; GIVES LONGER SERVICE

AUTOMATIC CONTROLS COMPLETELY WIRED AND FLAME-TESTED

GUN-TYPE OIL BURNER APPROVED BY UNDERWRITERS' LABORATORIES

BURNS UP TO AND INCLUDING NUMBER 2 OIL

The new Dravo *Paraflo* Heater makes available to you a complete line of oil-burning Dravo Space Heaters ranging from 200,000 to 2,000,000 Btu/hr output in the *Paraflo* or *Counterflo* series. Dravo also produces gas-fired space heaters in a range of 68,000 to 2,000,000 Btu/hr output in the Unit Heater and *Counterflo* models.

DRAVO

CORPORATION

PITTSBURGH • ATLANTA • BOSTON • CHICAGO • CINCINNATI CLEVELAND • DETROIT • INDIANAPOLIS • NEW YORK ST. LOUIS • PHILADELPHIA • WASHINGTON

Sales Representatives in Principal Cities

Manufactured and sold in Canada by Marine Industries, Ltd., Sorel, Quebec. Export Associates: Lynch, Wilde & Co., Washington 9, D.C.

Dravo Corporation, Heating Department
Dravo Building, Fifth and Liberty Avenues
Pittsburgh 22, Pennsylvania

Please send me complete information about the Dravo:

☐ *Paraflo* Space Heaters ☐ Gas-Fired Unit Heaters
☐ *Counterflo* Heaters

Ask for Bulletin BC-000-1324

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

CLEAN EDGES WITH A GOOD CUTTER-BUT CLEAN JOBS DEPEND ON

GOOD PIPE

ON the job or in the shop, you like to work with Youngstown pipe. Cutting is clean, fast and easy because Youngstown pipe is uniformly round and soft—true to size, even in grain structure, free of inclusions and hard spots. The name "Youngstown", rolled into every length, means GOOD PIPE.

QUALITY V YOUNGSTOWN SERVICE

7 POINTS OF UNIFORM GOODNESS IN
YOUNGSTOWN STEEL PIPE

uniform ductility - - uniform lengths - - uniform threading - - uniform weldability - - uniform wall thickness and size - - uniform strength and toughness - - uniform roundness and straightness

Youngstown
STEEL PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY
General Offices: Youngstown, Ohio - Export Office: 500 Fifth Avenue, New York 36, N. Y.
PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS - COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RAILROAD TRACK SPIKES

Meet the whole family!

. . . for Hot Water Space Heating Boilers
. . . for Hot Water Tanks and Heaters

There never was a relief valve that the heating industry took to its heart like it did the McDonnell No. 230.

Ingeniously simple in design, the No. 230 accomplished two big things: it measured up to the highest standards of dependability for such a device, and did it at a price level that was well within the reach of every boiler owner.

In the picture above you see this time-tested idea carried to its logical conclusion. Now this same uncompromising quality, and value, has been expanded clear across the board to cover the big hot water boilers as well as the little ones. In addition to the original ¾" valve you can now get 1" and 1½" sizes for larger boilers. For still larger boilers there are manifold assemblies—dual valves with a common inlet. These offer the very real advantage of keeping discharge in step with actual need . . . a smaller valve opening at 30 lbs. to take care of thermal expansion, and a bigger valve set at a slightly higher pressure always ready for any emergency.

For use on hot water tanks and heaters McDonnell 230 Series valves are available with standard opening pressures to answer all the jobs you're likely to come across. If need be, the valves can be furnished on special order with other pressure settings.

All of these valves comply fully with the ASME Code, and have been tested and Btu.-rated by the National Board of Boiler and Pressure Vessel Inspectors. All have the same basic operation; the same fine manufacture which uses only non-corrosive materials for all operating parts; the same independent-acting test levers which cannot interfere with valve operation even if tied down.

Now that you've met the McDonnell 230 family you should become fast friends. No one can question the need for pressure relief valves on hot water boilers, tanks and heaters. And no one can question your judgment when you choose from the McDonnell 230 Series to answer that need.

McDONNELL & MILLER, *Inc.*

3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

Your Jobber Stocks Them

Your best choice for every job

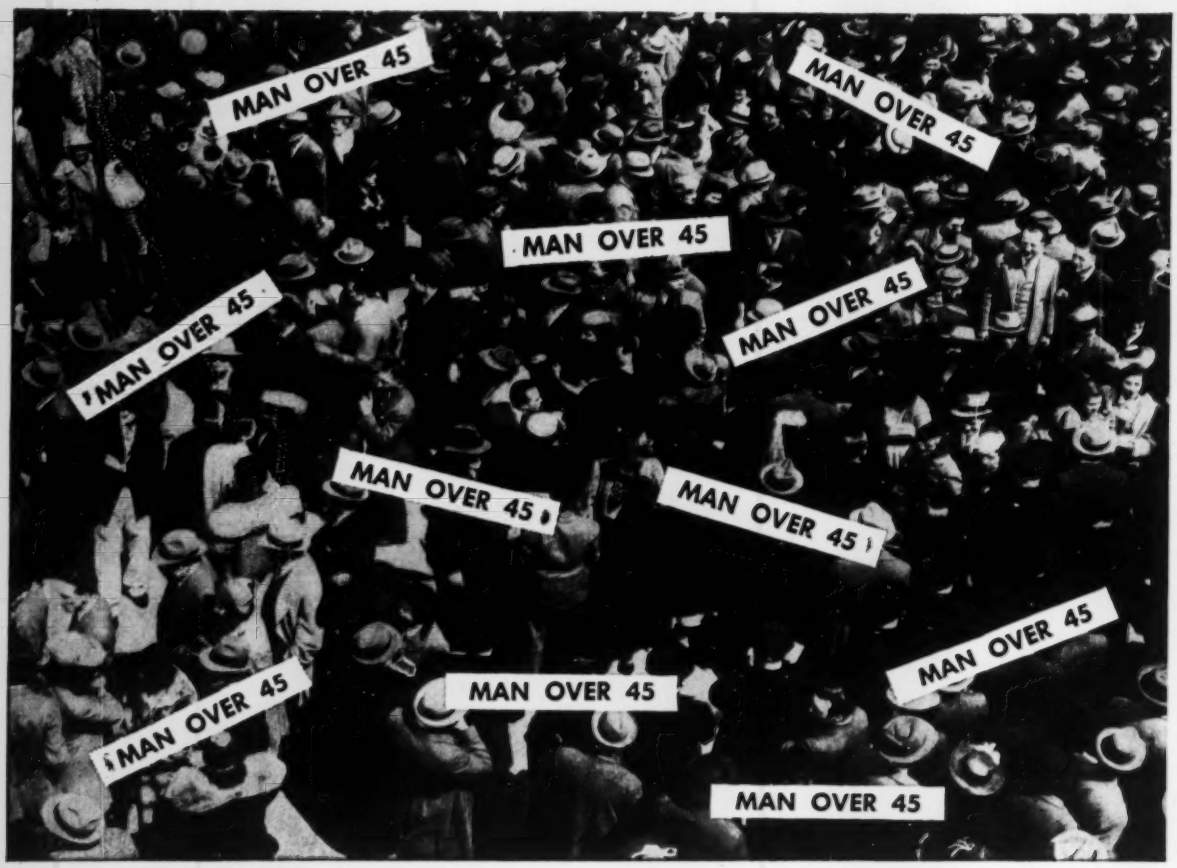
For Hot Water Space Heating Boilers

Boiler Size Btu./hr.	McDonnell Valve No.		Opening Pressure	Outlet (Female)	Inlet (Female)
303,000	230 ¾ Inch		30 lbs.	¾"	¾"
743,400	230 1 Inch		30 lbs.	1"	1"
1,025,100	230 1½ Inch		30 lbs.	1½"	1½"
1,488,000	230 M-1	Includes 230 ¾ Inch 230 M36	30 lbs. 36 lbs.	¾" 1½"	2"
1,928,400	230 M-2	Includes 230 1 Inch 230 M36	30 lbs. 36 lbs.	1" 1½"	2"
2,150,400	230 M-3	Includes 230 1 Inch 230 M45	30 lbs. 45 lbs.	1" 1½"	2"

For Hot Water Tanks and Heaters

Opening Pressure	McDonnell Valve No.	Capacity Btu./hr.	Outlet (Female)	Inlet (Female)
75 lbs.	230-75	502,000	¾"	¾"
100 lbs.	230-100	640,000	¾"	¾"
125 lbs.	230-125	783,000	¾"	¾"
150 lbs.	230-150	925,000	¾"	¾"

McDONNELL



But why MEN over 45?

Our doctors still don't know *why*, but if you are a man over 45 you are six times as likely to develop lung cancer as a man of your age twenty years ago. They *do* know, however, that their chances of saving your life could be about *ten times* greater if they could only detect cancer long before you notice any symptom in yourself. (Only 1 in every 20 lung cancers is being cured today, largely because most cases progress too far before detected.) That's why we urge that you make a habit of having your chest X-rayed every six months, no matter how well you may *feel*. The alarming increase of lung cancer in men over 45 more than justifies such precautions. Far too many men die needlessly!

Our new film "The Warning Shadow" will tell you what every man should know about lung cancer. To see this film and to get life-saving facts about other forms of cancer, phone the American Cancer Society office nearest you or simply write to "Cancer"—in care of your local Post Office.

American Cancer Society

WeldELLS®

...have set their own standards

Many of the largest users of Welding fittings refuse to accept any other fittings than WeldELLS.

They have found that when the name, WeldELL, is stamped into a fitting, that fitting can be accepted without question for any service for which it is designed.

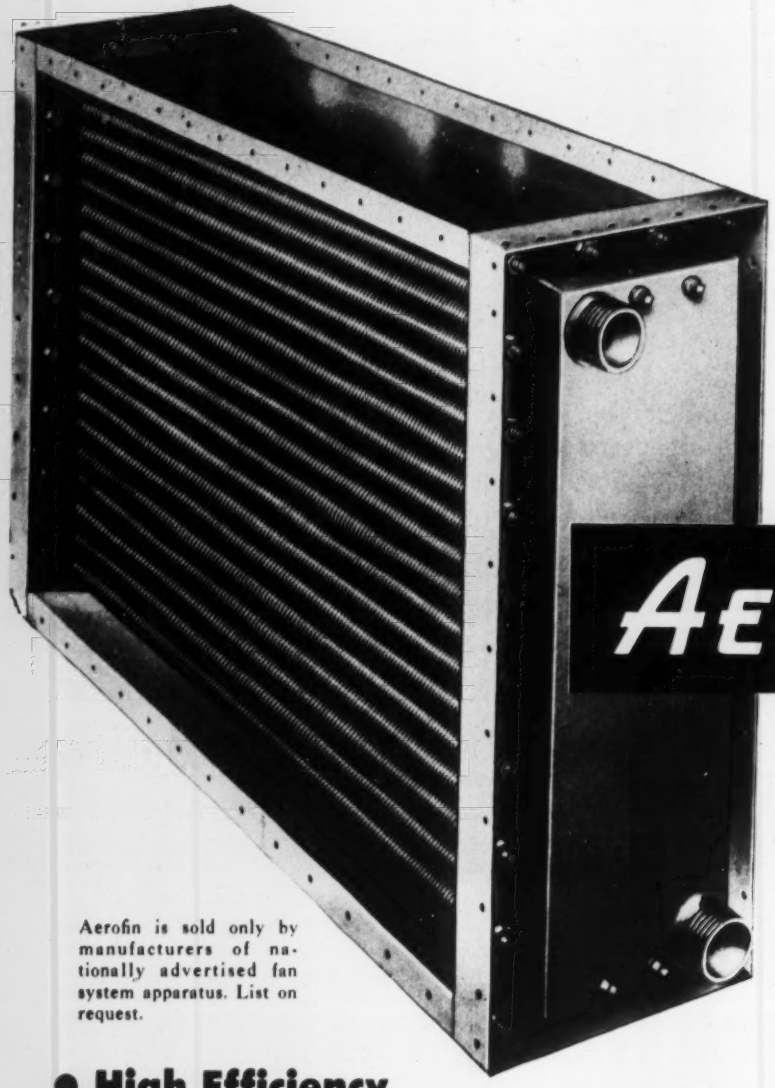
They have found that WeldELLS have features that please both the men who design and the men who erect welded piping . . . features that were pioneered by Taylor Forge . . . features that are combined in no other welding fittings.

They have found the answer to their every need in the greater range of sizes, weights and types of the WeldELL line . . . in the broader scope of materials.

For up-to-the-minute facts
see your Taylor Forge Distributor

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS, General Offices and Works: P.O. Box 485, Chicago 90, Ill.
Offices in all principal cities. Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada



AEROFIN

Heat-Transfer Surface

Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

● High Efficiency

● Long Service Life

● Low Maintenance Costs

You are assured of high efficiency in heating or cooling — long service life — low maintenance and service costs, when you specify Aerofin extended-surface heat exchangers.

The reason is obvious: Aerofin makes heat exchangers *exclusively* — offers you the results of unequalled experience, unequalled production facilities, unequalled materials testing and design research — and the guidance of a complete, highly skilled engineering staff, at the plant and in the field.

For the most practical solution to your heat-exchange problem, ASK THE AEROFIN MAN.

AEROFIN CORPORATION
410 South Geddes St.
SYRACUSE 1, N. Y.

The most convincing stamp of user satisfaction

ANOTHER REPEAT ORDER FOR SARCO

Tuberculosis Hospital, latest addition to Kings County Hospital Center, Brooklyn, New York.

Architect: James Gamble Rogers Successors: Rogers & Butler
Mechanical Engineers: Clark, MacMullen & Riley
Heating Contractors: Fred Brutschy Company, Inc., N.Y.C.
Specification Approval: N.Y.C. Dept. of Public Works

First in 1930 *and seven times since*

Kings County Hospital Center relies on Sarco Heating Specialties

Whenever you find equipment specified and accepted eight times running, you can be sure there's a sound reason for it.

At Kings County Hospital Center, that reason is *Sarco dependability*.

Since 1930, Sarco heating specialties were installed on eight separate jobs. The latest installation was made in the new Tuberculosis Hospital.

Now, over 6000 Sarco products contribute to the dependability and efficiency of Kings County Hospital Center's vitally important heating system and hot water supply. Sarco heating specialties are installed throughout, including the nurses' home, laundry and kitchen. Sarco self-operated temperature regulators are used on hot water storage.

There's no more convincing evidence of Sarco dependability than this impressive record of repeat orders. Specify Sarco on your next job and be assured of similar user satisfaction.

We'd be happy to send you full information on Sarco's complete line of heating specialties.

SARCO

Sarco quality assures satisfaction

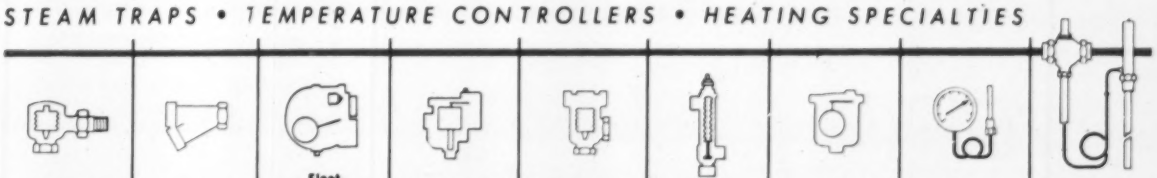
Here's why so many architects, engineers and heating contractors specify and install Sarco

— job after job.

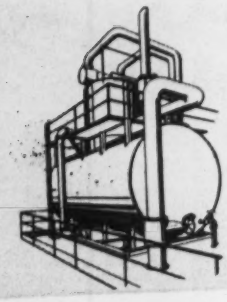
- Proven dependability
- Trouble-free service
- Complete line from one reliable manufacturer
- Nationally known and preferred

SARCO COMPANY, INC., Empire State Building, New York 1, N. Y.
Sarco Canada, Ltd., Toronto 8, Ontario . . . Represented in Principal Cities

STEAM TRAPS • TEMPERATURE CONTROLLERS • HEATING SPECIALTIES



This 10,000 lb. per hour PACKAGED DEAERATING HEATER



has the same design and performance characteristics as this 1,000,000 lb. per hour central station heater

Unlike the central station plant, the small steam generating plant must often function with little operating attention. That is the very reason why this plant should insist on equipment that will give dependable, fool-proof, 24-hour-a-day service with a very minimum amount of maintenance attention.

A well-designed deaerating heater in this plant protects the boilers, feedwater heaters, and condensate return lines . . . it must indeed be a rugged, dependable watchdog.

That's why Graver designed the packaged deaerating heater with the *same* materials of construction . . . design features . . . construction methods . . . workmanship . . . accessories . . . and guarantees . . . that are built into heaters for the largest power generating stations of 1,000,000 lb. per hr. or more.

In addition, these Graver Heaters are *standardized* in design . . . they are pre-engineered for quicker shipment and for lower cost of installation; and they are furnished as *packaged* units, with all necessary parts and accessories for speedy, easy installation.

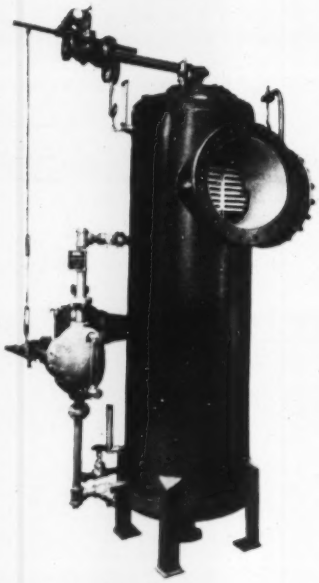
Write for descriptive brochure including dimensional and capacity data which will permit you to select the correct heater for your requirements.

GRAVER WATER CONDITIONING CO.

Division of Graver Tank & Mfg. Co., Inc.

Dept. HPA-PH 216 WEST 14th STREET, NEW YORK 11, N. Y.

In Canada: The Bird-Archer Co., Ltd., Cobourg, Ontario
In Mexico: Proveedores Tecnicos, S.A.; Puebla 259, Mexico 7, D. F.



FEATURES OF GRAVER PACKAGED DEAERATING HEATERS

Spray or Spray-Tray Design . . . as best suited for particular plant conditions

Corrosion-Resistant Construction . . . vent condenser, spray valves and tray cubes of stainless steel

Internal Vent Condenser . . . avoids tube bundle cleaning, reduces weight and headroom

Self-Adjusting Spray Valves . . . highest efficiency at all loads, accessible from exterior

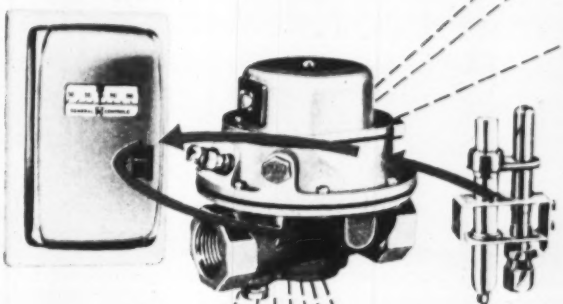
Tray Cubes . . . rugged construction, light weight, convenient size

Built in both vertical and horizontal types for capacities up to 100,000 lb per hr.

GRAVER ***Deaerating Heaters***

GW 472

The **BEST** *automatic control system for every heating need*



CIRCULATORS

CENTRAL WARM AIR HEATERS

COMMERCIAL WATER HEATERS

For universal control of gas-fired equipment it's General Controls' BX-69 package set, with positive B-60 control valve and a pilot-generator delivering 700 millivolts of electrical energy to operate the system independent of outside electrical power. Silent . . . safe . . . easy to install . . . the BX-69 operates on natural, manufactured, mixed, liquefied petroleum or sour gases. Wide application to gas fired appliances and wide range of fuel gases make the BX-69 the *best* self-generating all gas control system.

GENERAL CONTROLS

Glendale, California • Skokie, Illinois

Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls for Heating, Home Appliances, Refrigeration, Industrial and Aircraft Applications.

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FLOOR FURNACES

GAS RANGE HEATERS

GAS RADIATORS

WALL HEATERS

GAS FIRED BOILERS

AIR CONDITIONING UNITS

COMMERCIAL & INDUSTRIAL OVENS

In Connecticut, a new idea.

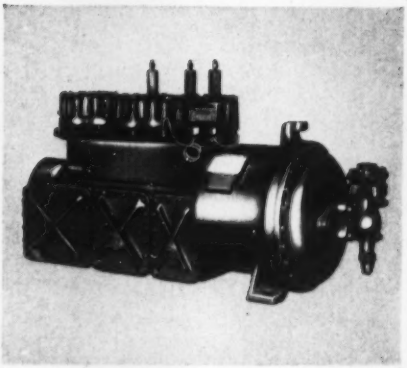
CHILLED COOLANT

BOOSTS BRASS OUTPUT

Here's an unusual application: a stock Westinghouse air conditioning compressor which speeds up rod production. First of its kind in the brass industry.

At Scovill Mfg. Co., they roll ¼" rod down to ¼", using special 12-stand mills running 24 hours a day. Our Connecticut distributor, J. P. Salmini Co., helped them improve this process. By pumping chilled coolant over the rod before it enters the rolls, they get these profit-making benefits: 1) increased output; 2) life of rolls tripled; 3) a better and more uniform finish; and 4) cleaner working conditions due to reduced oil smoke.

If your problem is product cooling—or process or comfort air conditioning of any kind—we can help you. Experienced Westinghouse distributors like J. P. Salmini Co. are located across the nation. Let one of them increase your profits with new ideas. He's listed under Air Conditioning in your classified telephone book. Westinghouse Air Conditioning Division, Hyde Park 36, Mass.

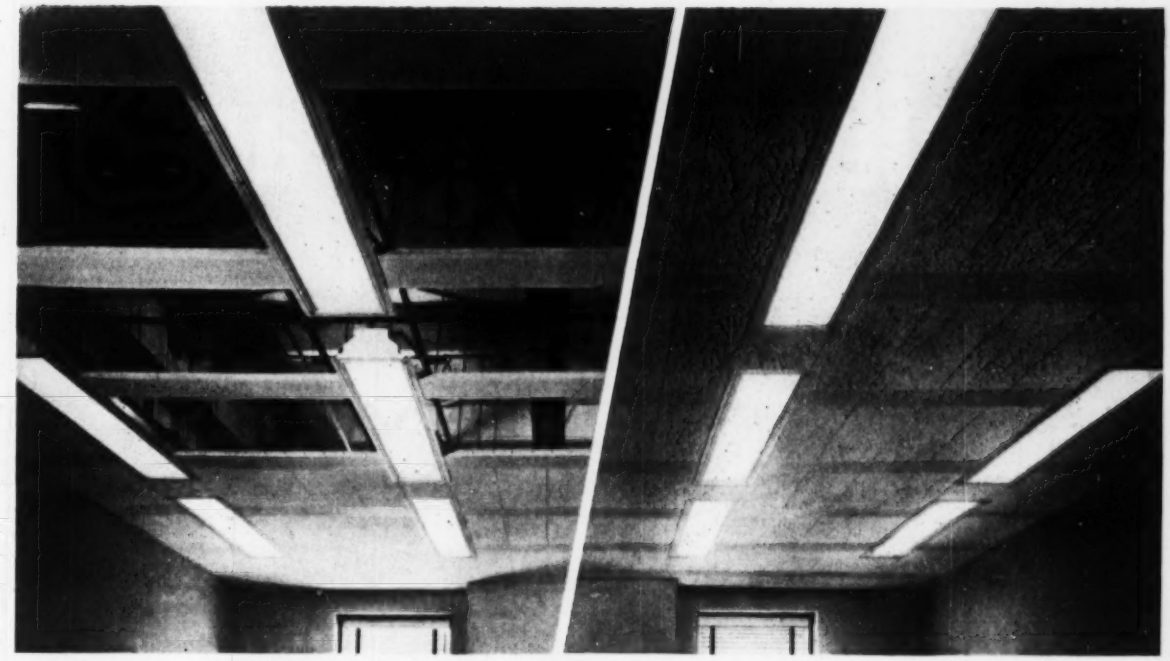


This is the compact, lightweight compressor which not only makes these production savings possible, but adds its own savings: less maintenance, longer life, peak efficiency and low operating cost. The hermetically-sealed design is the reason. No belts, pulleys, or shaft seals. It cools itself with the refrigerant it pumps!

WESTINGHOUSE AIR CONDITIONING

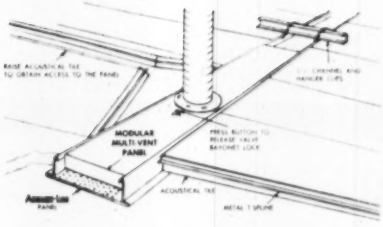
YOU CAN BE SURE... IF IT'S Westinghouse

J-80324



new! *Out-of-sight* AIR DIFFUSERS for acoustical block ceilings!

Now Pyle-National Multi-Vent® air diffusing panels, adapted for concealed installation in Celotex Acousti-Line ceilings, provide advantages heretofore possible only with metal pan.



The perforated face of Acousti-Line metal suspension panels act as diffusing plates for Multi-Vent units. No special supports are needed. Flexible connection minimizes need for accurate alignment between duct opening and Acousti-Line panels.

Note ready access to Multi-Vent unit for cleaning or valve adjustment.

NEW SMUDGE-FREE OPERATION—Multi-Vent's low velocity air delivery eliminates the dirtying or discoloration of adjacent acoustical blocks, a costly maintenance problem with high velocity diffusion.

NEW BEAUTY—Out-of-sight installation eliminates all protruding outlets and unsightly grilles. Permits complete freedom of interior design and decoration.

NEW LOWER INSTALLATION COST—Multi-Vent units can be assembled, connected to the duct, and seated in the metal suspension panels in just a few seconds. No tools are required . . . no cutting of blocks necessary.

AND, MOST IMPORTANT OF ALL—Air distribution by Multi-Vent's gentle pressure displacement assures perfectly even air motion and exceptional uniformity and control of room temperatures. The total absence of strong air streams or blow eliminates all usual sources of draft complaints and permits complete freedom in relocating partitions.

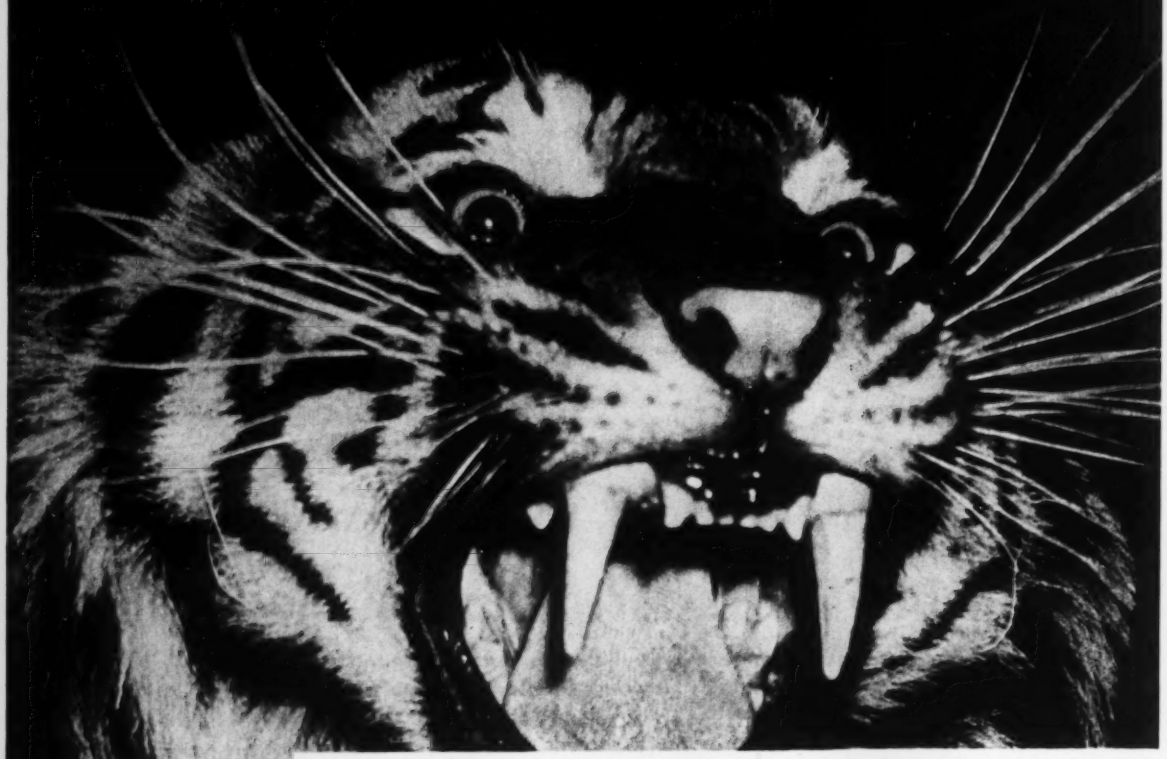
For complete information about Multi-Vent installations for all types of ceilings consult the Pyle-National Sales Engineer in your vicinity, or write direct.

MULTI-VENT DIVISION
Sales and Engineering Representatives in Principal Cities of United States and Canada

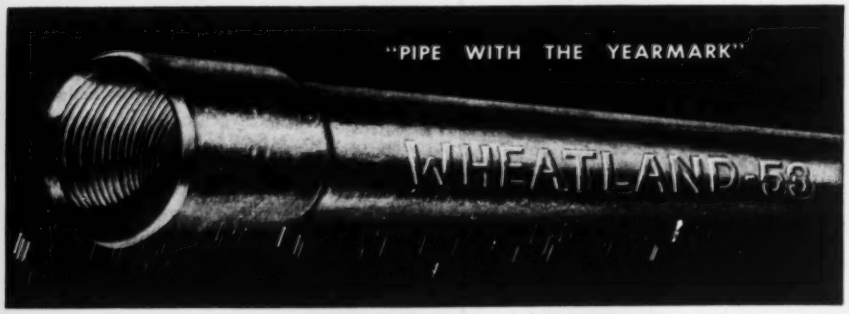
THE PYLE-NATIONAL COMPANY
1373 North Kostner Avenue Chicago 51, Illinois

TURBO-GENERATORS • FLOODLIGHTS • PLUGS AND RECEPTACLES • CONDUIT FITTINGS

"Built-in" endurance



Where "built-in" strength and endurance are required, Wheatland wins on performance. It takes more than know-how to maintain that reputation. It takes a constant search for improvements in processing. For your assurance of newest methods, select the pipe its makers are proud to stamp with the year of its manufacture.



WHEATLAND TUBE CO

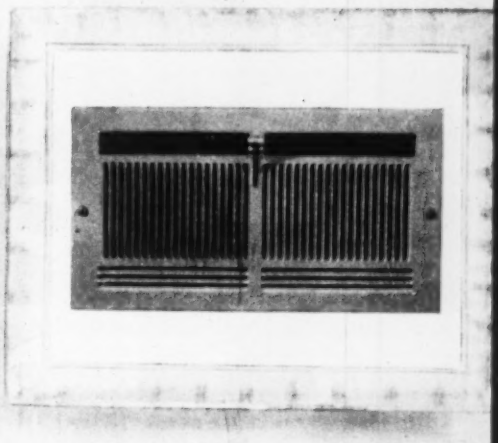
BANKERS SECURITIES BUILDING, PHILADELPHIA 7, PA.

comfort in modern living

Barometers may rise and fall . . . but
indoor comfort will remain constant if you use

Standard's model 551 perimeter wall register

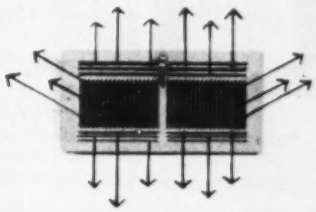
Standard's new perimeter Wall register gives 4 way diffusion along the outer cold walls for balanced warm air circulation. Standard's exclusive, new Fractionator Volume Control means one-time setting for positive air control. When you use Standard Perimeter Wall or Baseboard registers you are giving complete hemispheric heating and cooling comfort.



features.

- new fractionator volume control
- metallic finish
- standard screw holes
- single shutter control
- smart appearance
- for sidewall installation

4-way diffusion for balanced air circulation



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chicago 32, illinois

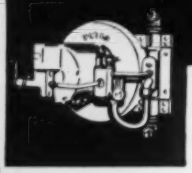
avoid trouble and complaints

Petro OIL BURNERS

Specialists in oil heating for 50 years

Industrial Oil Burners

Rotary type. Burn low-cost, heavy fuel oil with complete reliability. Models for every industrial need. Capacities up to 200 gallons per hour.

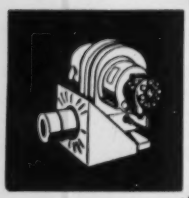


Combination Oil-Gas Burner

This commercial industrial burner is the answer to seasonal fuel shortages. Makes possible advantages in economical fuel buying.

Residential Furnaces and Boilers

Made in popular sizes to fit the heating needs of homes from 4 to 10 rooms. Extremely compact and attractive. Real fuel savers.

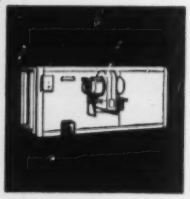


Conversion Units

Efficient, trouble-free oil burners for home and commercial use. Capacities up to 20 gallons per hour.

Horizontal Furnace

Hang it or hide it—this winter air conditioner fits anywhere. Available in five models from 80,000 to 180,000 Btu's (output at bonnet).



Complete Line

There's a size and type of Petro oil burner, or home furnace or boiler, to fit every oil firing need. The name Petro, since 1903, has been known and respected wherever oil burning equipment is used.

Simple, Dependable Operation

Petro oil burners cost the plant operator or homeowner less to own and operate because their performance is proved and simple. The fine reputation Petro equipment enjoys, and its popularity with owners, is the result of this simplicity and traditional dependability.

Easily Installed

Petro oil burners are compact and well built. Heavy mounting flanges, protected wire connections, easy access to oil and ignition lines, are all features which help make Petro oil burners the favorite of contractors and dealers all over the nation. They save installation time —they cut service calls.

Get Latest Information

Illustrated literature and specification sheets gladly sent free. Write Petro, 3190 W. 106th St., Cleveland 11, Ohio. In Canada, write 2231 Bloor St., Toronto, Ont.

INDUSTRIAL AND COMMERCIAL OIL, GAS AND COMBINATION OIL-GAS BURNERS, RESIDENTIAL OIL BURNERS, OIL AND GAS FURNACES AND BOILERS.

PETRO

T. M. REG. U.S. PAT. OFF.

50 YEARS OF LEADERSHIP IN AUTOMATIC HEATING

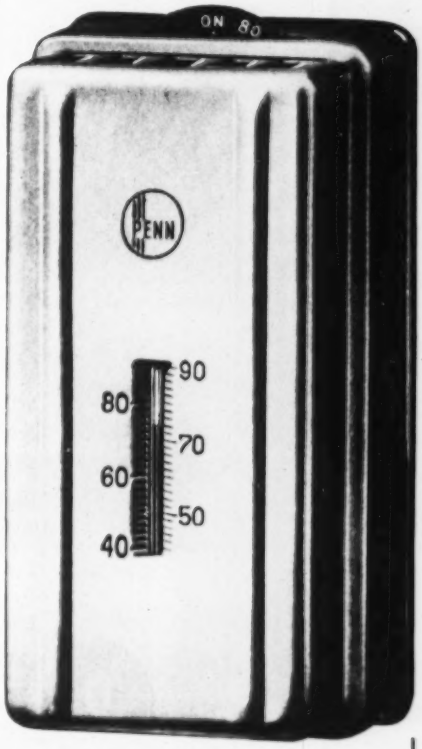
3190 W. 106th St., Cleveland, Ohio

In Canada, write 2231 Bloor St., Toronto, Ont.

3 things happen when your UNIT HEATERS have PENN *individual controls!*

First, you get selective heating for each department or section of a plant depending upon its needs. Once set, the operation is automatic. PENN's famous *heat anticipation* holds temperature closely to the selected level for real heating comfort.

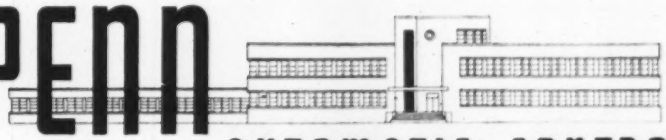
Second, during the heating season, the built-in "ON-OFF" switch featured in the PENN unit heater thermostat is a great fuel saver. A mere rotation of the dial to "OFF" position stops heat flow during idle periods . . . or to little-used areas . . . or to areas where heat can escape such as receiving or shipping rooms which may be exposed to outside temperatures for long periods.



Third, during the summer, this *same* switch permits manual control of unit heater fan for ventilation whenever desired. For continuous fan operation, merely rotate dial to "ON" position.

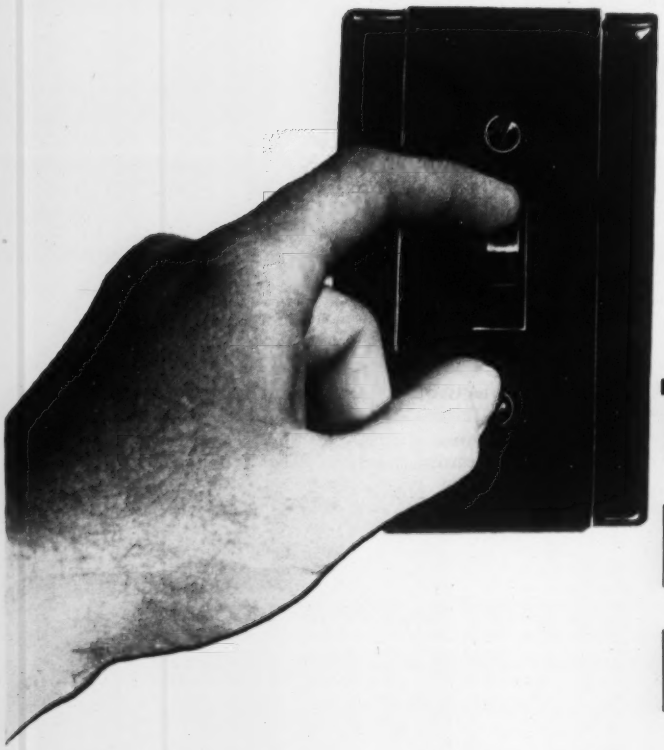
Learn more about this *better control* for unit heaters. Ask your manufacturer, wholesaler or write **Penn Controls, Inc., Goshen, Indiana.** Export Division: 13 E. 40th Street, New York 16, N. Y., U.S.A. In Canada: Penn Controls Limited, Toronto, Ontario.

DID YOU KNOW . . . In addition to heating controls, PENN has a complete line of refrigeration and air conditioning controls for your specific needs. Included in this line are cooling thermostats, humidistats, water valves, solenoid valves, magnetic starters, temperature and pressure controls, oil protection controls for pressure-lubricated refrigeration compressors and many others. Bring your control problems to PENN . . . you'll get the correct solution.



AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, GAS APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES



TAKE A TIP FROM A LITE SWITCH

It's placed at a convenient location where you enter, not the opposite. By the same token, the control panel box of an industrial heater, is needed within easy sight and reach of all burner adjustments. Olson Heaters provide this convenient location and it pays dividends time and again.

Further, the control panel of an Olson is soundly engineered for other important features — It's dust tight and damp proof. Thermostat and safety controls operate on 110 volt current directly from the transformer in the control box.

The fact that Olson Heaters are built rugged for dependable service cannot be denied. — Write for the detailed step-by-step catalog and you'll know why.

Olson

DIRECT FIRED HEATERS
Gas, Oil, Coal or Dual Gas and Oil

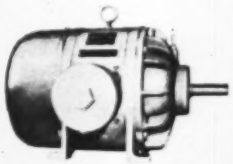
Arthur A. Olson & Company
Canfield, Ohio
Please send me your catalog F50.
Name .....
Firm Name .....
City ..... **State** .....

ARTHUR A. OLSON & COMPANY
BROAD ST. · CANFIELD, OHIO

DEPENDABILITY...

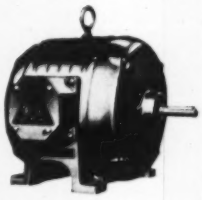
that minimizes costs

Delco Motors

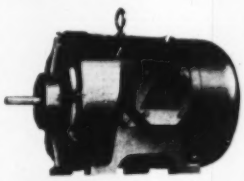


Explosion-proof motor

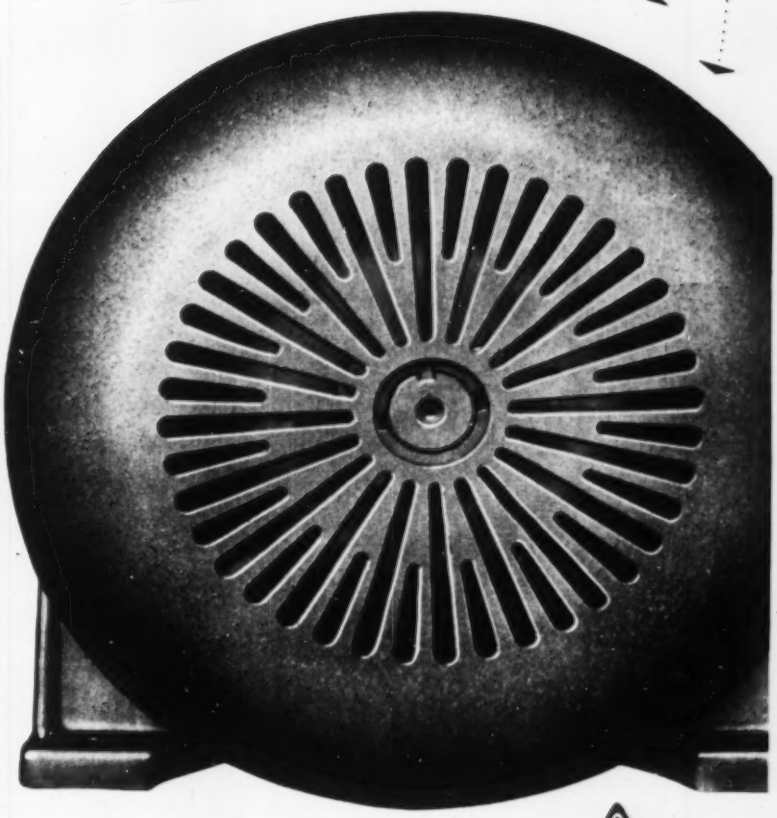
Open ball-bearing motor



Totally enclosed ball-bearing motor



Totally enclosed fan-cooled motor



With Delco integral motors on your machines you have a cost factor on which you can depend.

For Delco designs and builds with one idea in mind—to produce motors that will run dependably, under extreme conditions, for record-breaking periods of time.

Put your trust—and your motor dollars—in Delco motors . . . your nearest Delco sales office will help you with all details.

DELCO DAYTON OHIO

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Dayton, Ohio

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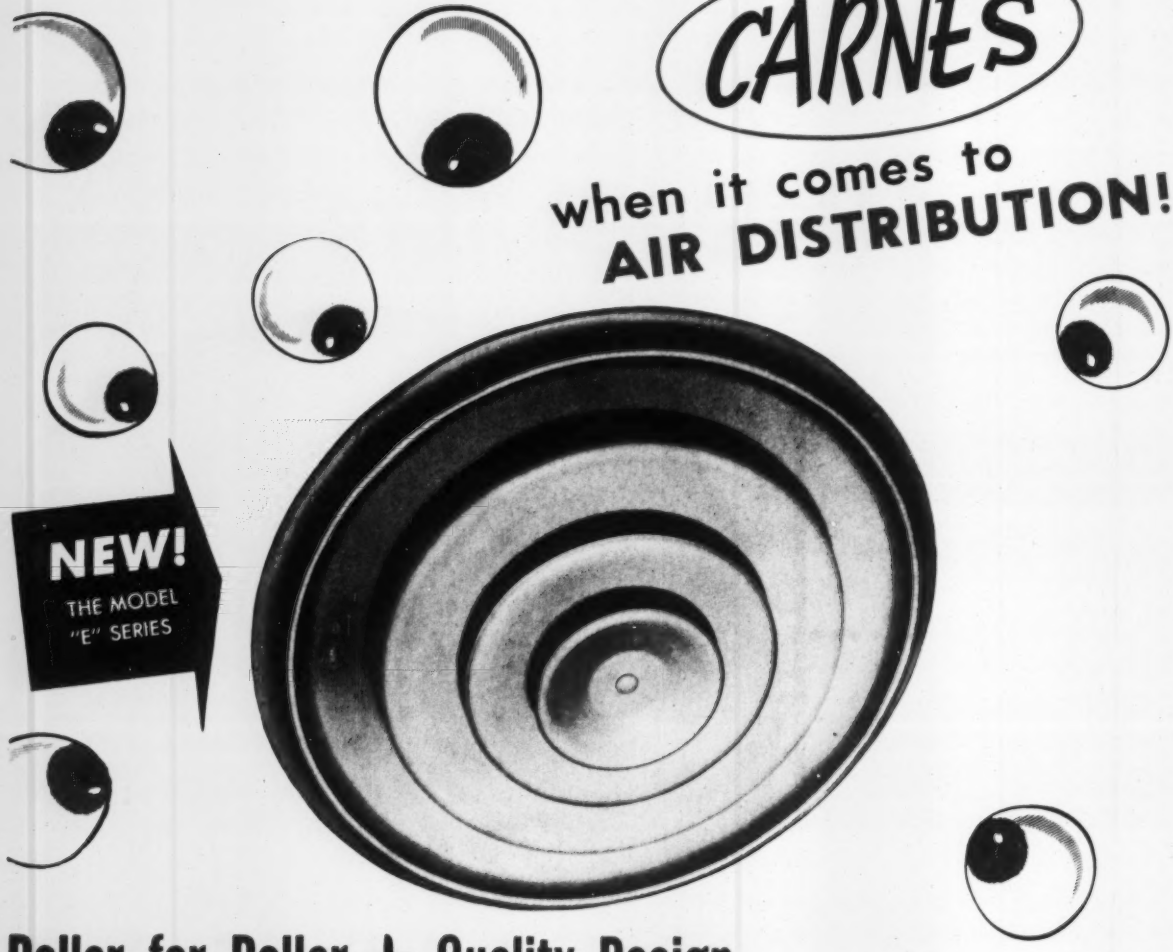
that's right, all eyes are on CARNES when it comes to AIR DISTRIBUTION!



Dollar for Dollar + Quality Design you'll be way ahead with the CARNES line!

You bet! Carnes ceiling air diffusers are the talk of the industry. For here is a complete line of beautifully-styled, soundly engineered diffusers that carry all the quality an architect or contractor can ask for . . . plus lower prices that fit into present day building budgets!

Carnes diffusers are offered in a complete range of sizes, for all heating and cooling systems, are extremely quiet in operation, afford easy installation features, and are fully adjustable for all air patterns.

Illustrated are the models E and EJ ceiling diffusers. Both look alike. However, the Model E is a fixed cone diffuser permitting adjustment for either horizontal, vertical or intermediate air pattern by removing inner cones and setting in any fixed pattern desired. The Model EJ permits this adjustment by simply turning the center cone to obtain any air pattern from horizontal to vertical. The Model EJ is especially adaptable for use on high ceilings or for spot cooling or heating applications.

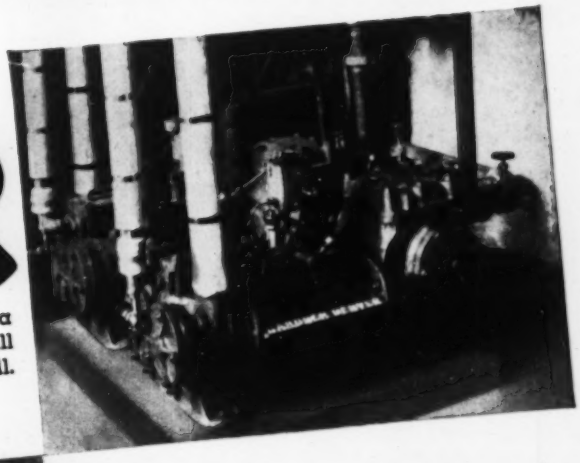
Complete descriptive literature on all Carnes Diffusers is immediately available. Write for information, selection charts and engineering data. You'll like doing business with Carnes . . . the most talked about name in air distribution ceiling outlets. Remember, you can't beat quality at economy! Write W. R. Carnes Co., Verona, Wis.

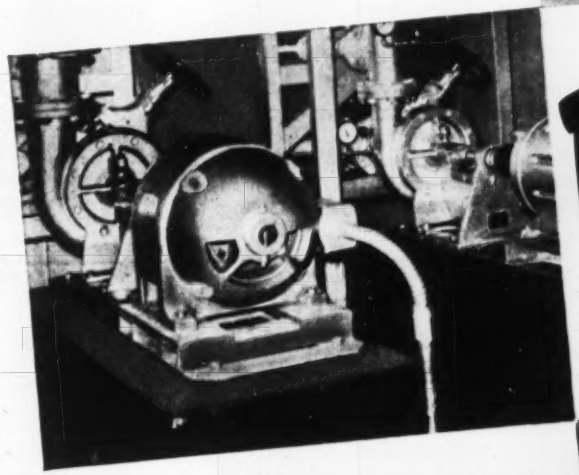
MODEL ER SUPPLY & EXHAUST. *Same style as E and EJ. Back view shows the Model SSD Supply Damper and the Model SEDE Exhaust Damper installed in unit. Use of these dampers makes balancing the system a simple matter.*

CARNES

POWER

Installed in a New Orleans plant in 1907, a Gardner-Denver Duplex Pump like this is still in use—is still called the best pump in the mill.



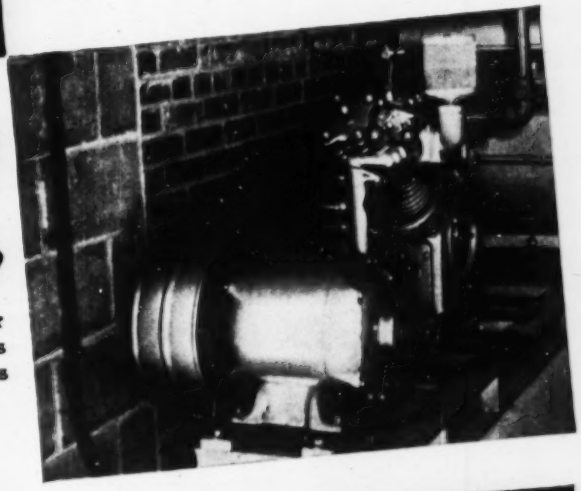


ROOM

A midwest water works reports it has operated a Gardner-Denver Centrifugal Pump for 17 years, with no repairs.

TALK

In a Canadian laundry, a Gardner-Denver Air-Cooled Compressor has run for 8 years steady—without even having the valves cleaned.



TELLS THE STORY OF...

CUSTOMER SATISFACTION WITH GARDNER-DENVER EQUIPMENT

Send for descriptive bulletins.

SINCE 1859 **GARDNER-DENVER**

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd.,
14 Curity Ave., Toronto 13, Ontario

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

ALLIS-CHALMERS
Air Conditioning
PUMPS

Easy-to-Install pumps

MEET 90% OF AIR CONDITIONING NEEDS

FHP pump

Up to 80 gpm, heads to 125 feet.

Compact pump and motor requires only two bolts for installation. Rigid construction holds alignment for longer bearing and seal life. Mechanical seal. Open impeller economy model does adequate job on many installations at very low cost. Closed impeller model for higher heads. Also available as frame-type pump for separate mounting.

Electrifugal pump

Up to 500 gpm, heads to 220 feet.

Only pump with unit-cast frame. Motor and pump are mounted on a single shaft in a one-piece rigid cast-iron frame. Alignment is rigidly held but there is plenty of space for maintenance. Installation requires only four bolts. Standard packing or mechanical seal available. Also built as frame-type pump for separate mounting.

Supporting adapter pump

Up to 2500 gpm, heads to 550 feet.

Flange motor and pump mounted on sturdy cast-iron supporting adapter. Motor and pump use same shaft. Rigidity assures vibrationless operation and long bearing life. Only four bolts required for installation. Available with standard packing or mechanical seal. Built in same ratings as frame-type pump for separate mounting.

FREE ENGINEERING HELP

YOUR ALLIS-CHALMERS PUMP REPRESENTATIVE is thoroughly familiar with pump problems in air conditioning equipment. He can offer you valuable suggestions in planning your equipment and installations. Call your Allis-Chalmers Authorized Distributor or District Office when you need help with your pump problems.

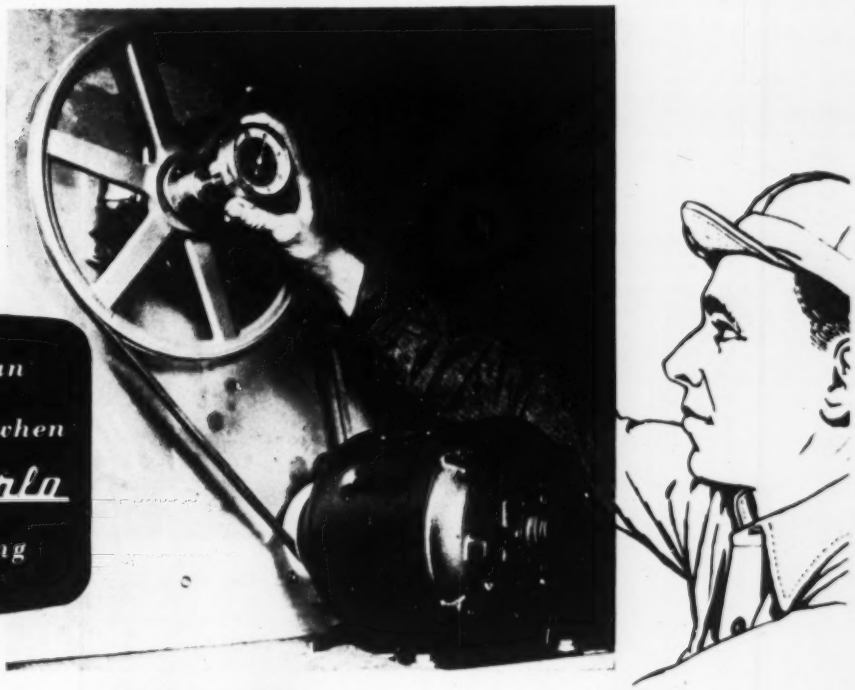
Write Allis-Chalmers, Milwaukee 1, Wisconsin, for centrifugal pump Bulletins 52B7529, 52B6140 and 52B6083 describing these air conditioning pumps. A-3971

Electrifugal is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

you get MORE than just equipment when you specify Marlo *Air Conditioning*

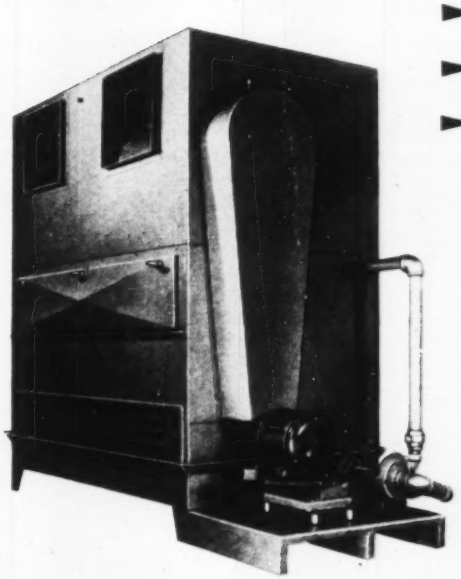


for example... Marlo

DRIVES are

- **engineered**
- **aligned**
- **tested**

for more efficient operation
for longer life



Precise engineering, aligning and testing of drives is typical of the concern for detail which makes Marlo equipment superior.

Pulleys are accurately aligned with precision instruments, belt tensions adjusted for maximum power and minimum wear. All drives up to 5 HP have variable pitch on motor for adjustment to meet field conditions.

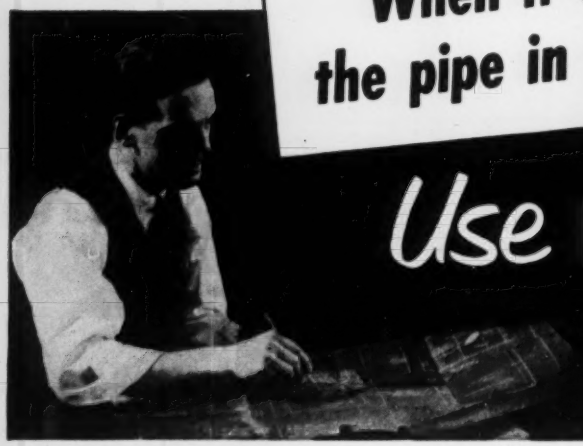
You will find that an investment in Marlo equipment will return big dividends in more efficient performance . . . longer life . . . lower maintenance cost.

Marlo COIL COMPANY

Manufacturers of COOLING TOWERS • EVAPORATIVE CONDENSERS • INDUSTRIAL COOLERS • AIR CONDITIONING UNITS • MULTI-ZONE UNITS • BLAST HEATING & COOLING COILS

Saint Louis 10, Missouri

When it comes to the pipe in your plans—



Use NATIONAL all the way!

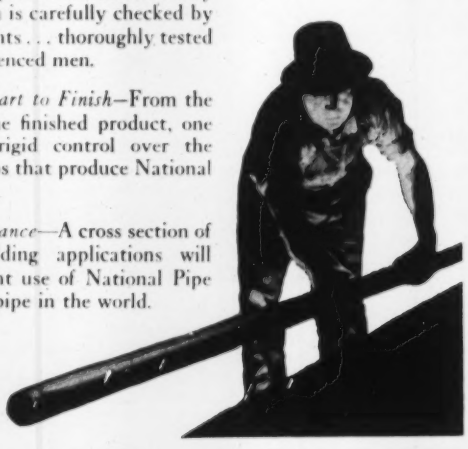
WHETHER you are installing a conventional hot water or steam heating system, fire control and plumbing lines, a modern radiant heating application or pipe for a snow melting system, remember that NATIONAL, the world's most widely used pipe, has all the necessary qualities for complete adaptability in all these services. This means to you—no worries, no doubts, no uncertainties. The choice of NATIONAL Pipe relieves you of any and all further checks or investigations. It's as easy and as simple as that.

Why? Well, "old timers" will tell you that confidence in NATIONAL to fill the bill is born of years of experience and observation, upon thousands and thousands of installations in structures of all kinds. But most important of all, it is based on the comforting knowledge of NATIONAL'S uniform, dependable, trouble-free performance, the kind of performance that you can feel proud to pass on to your customers.

For over three quarters of a century, each new generation of pipe users has looked to NATIONAL with complete confidence to meet all mechanical requirements. They know that while old in name and rich in service records, it is ever new and modern to fit today's requirements. And so, whatever type of service your plans call for, we are sure you will find both satisfaction and profit in standardizing on NATIONAL "all the way."

Here's why *NATIONAL* Pipe gives the most service per dollar cost:

1. *It's Uniform Throughout*—National Pipe is uniform in metallic structure, ductility, strength, corrosion resistance, surface finish and diameter.
2. *Threads and Cuts Easily*—Absence of slag inclusions, laminations and blisters assures smooth, strong threads . . . clean cuts.
3. *Coils and Bends Well*—National Pipe has that extra strength and ductility so necessary to meet the demands of close and exacting fabrication.
4. *Makes Sound Joints*—Uniformity and accuracy in manufacturing have made unequaled pipe jointing records for National Pipe . . . whether welded or threaded.
5. *It's Scale-Free*—National Scale-Free Pipe avoids damage to valve seats and clogging of small orifices.
6. *It's Spellerized*—Special rolls work the bloom surface to eliminate irregularities and produce a dense, uniform surface.
7. *Constantly Improved*—For over 60 years, National Steel Pipe has constantly been improved to meet the most difficult requirements.
8. *It's tested and Inspected*—Each and every stage of production is carefully checked by the finest instruments . . . thoroughly tested by the most experienced men.
9. *Controlled from Start to Finish*—From the raw material to the finished product, one organization has rigid control over the manufacturing steps that produce National Steel Pipe.
10. *Nationwide Acceptance*—A cross section of industrial or building applications will show a predominant use of National Pipe . . . largest selling pipe in the world.



NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S NATIONAL *Steel* PIPE

UNITED STATES STEEL

The JOY AXIVANE® FAN

A JOY Axivane Fan in a commercial store—chosen for its low noise level, compactness, and simple and easy installation.

Mounts Right in the Air Duct—

Saves space, installation costs, gives you quieter, more efficient ventilation!

Write for Bulletins, or

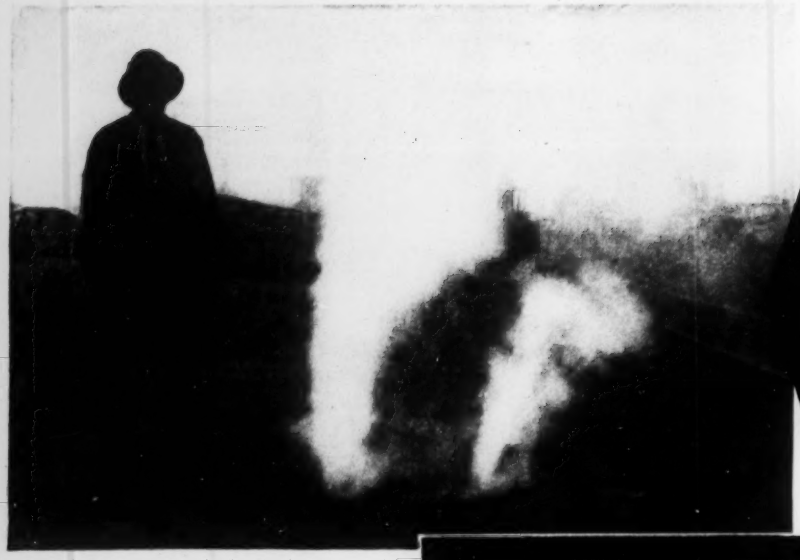
Consult a Joy Engineer

WBD18039

JOY MANUFACTURING COMPANY

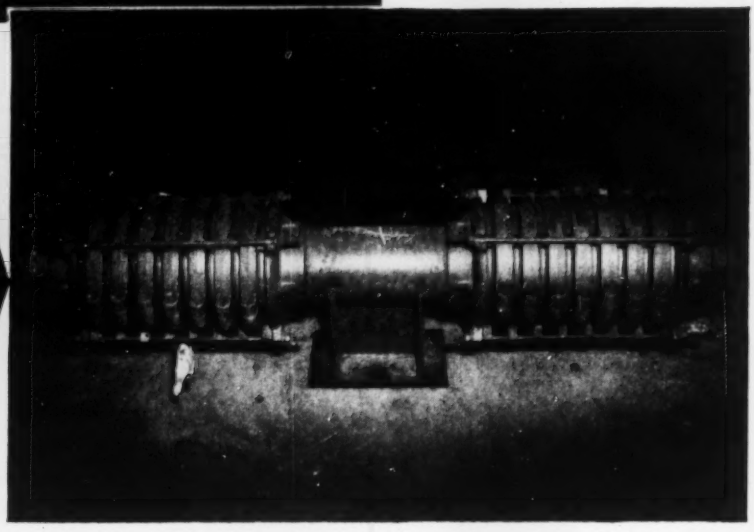
GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO



THIS STEAM LOSS WAS STOPPED FOR LIFE...

WHEN THIS FLEXON EXPANSION JOINT WAS INSTALLED



THREE TYPES AVAILABLE

FREE FLEXING—*Available in sizes from 3" through 48" I.D. in copper or stainless steel. Suitable for pressures to 30 psi, temperatures from minus 20° F. to 800° F.*

CONTROLLED FLEXING — (Illustrated above) *Available in sizes from 3" through 48" I.D. in copper or stainless steel. Suitable for pressures to 300 psi, temperatures from minus 20° F. to 800° F.*

FLEXONIFLEX—*Integral ring type. Available in sizes from ½" pipe through 6" pipe. Suitable for pressures to 5500 psi, temperatures from minus 400° F. to 1600° F.*

Steam loss through antiquated expansion joints in the shipyard where the upper photo was taken was calculated at over $17,500 per year before modern Flexon Expansion Joints were installed. Flexon Expansion Joints cannot leak . . . they are uni-metal assemblies which when properly installed become a part of the pipe. Unlike the joints which they replaced in this shipyard, Flexon Expansion Joints require no maintenance . . . there is no packing to take up or replace. Just install them and forget them.

If you're letting dollars escape through leaky, troublesome expansion joints, ask your Flexonics representative to show you how Flexon Expansion Joints can put an end to this problem, or write for the Flexon Expansion Joint Bulletin.

Flexonics *Corporation*

EXPANSION JOINT DIVISION

1391 S. THIRD AVENUE · MAYWOOD, ILLINOIS

FORMERLY CHICAGO METAL HOSE CORPORATION

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

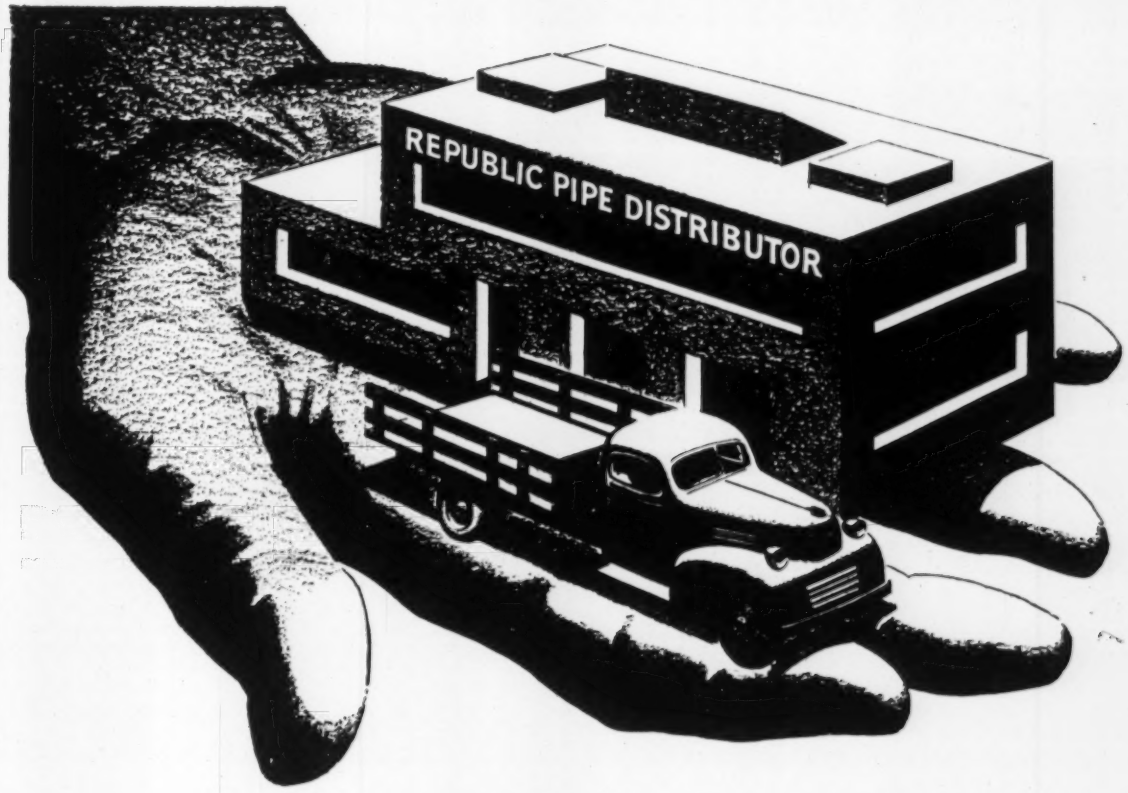
Flexon identifies products of Flexonics Corporation that have served industry for over 50 years.

Flexible metal hose

Expansion joints

Aircraft components

Metallic bellows



Here's your Piping Stockroom

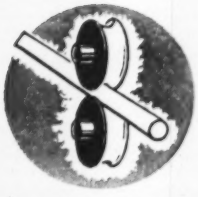
...with no investment

When you use the services of the Republic Steel Pipe Distributor, it's just like having your own stockroom. With a number of important exceptions.

You have no capital investment. No inventory losses trying to maintain your own stocks. No insurance and handling costs.

The Republic Pipe Distributor's stockroom becomes *yours*. He carries everything you need for complete plumbing, heating, refrigeration, air conditioning, process and industrial piping, or other piping jobs. That includes a full line of pipe in sizes you need . . . plus fixtures, controls, tools, and other items. And he'll get your order to you in a hurry . . . often in a few hours . . . whether it's a few lengths of pipe, or a truckload.

All these services are yours . . . for the asking. And they're as close as your telephone. Successful operators find it profitable to do business with the Republic Steel Pipe Distributor. You will, too. Call him, today.



Easy to bend, thread, and close coil
Easy to weld by all methods
Uniformly ductile
Uniformly strong
Uniformly clean and scale-free
Uniform wall thickness, diameter, concentricity
Economical uniform lengths, extra long lengths

REPUBLIC STEEL

STEEL PIPE

JENKINS PRACTICAL PIPING LAYOUTS 70

How to plan an INDUSTRIAL WASTE TREATMENT SYSTEM

In many areas, stringent codes have been drawn up to regulate the types and condition of waste which may be discharged into streams and rivers, in order to conserve existing water supply sources.

Industrial discharges usually require chemical treatment, and one of the most common problems encountered is the neutralization of acid waste. In the system shown here, lime is used as the neutralizing agent. The waste normally flows to a digester which allows for settlement of solids and serves as a storage center. Flow from the digester to the treatment tank is regulated by a liquid level controller.

The treatment tank is equipped with an agitator which mixes the waste with the lime slurry to provide a neutral solution. The proportion of lime to be added is determined by a recording pH regulator, which operates the control valve on the slurry line and admits the required amount of slurry for neutralization. The slurry is made by admitting quicklime and water to the lime slurry mixer, which is equipped with an agitator. Emergency lines for direct discharge bypassing the treatment system are indicated in the diagram.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

Diagram by Huxley Madeheim, Consulting Engineer
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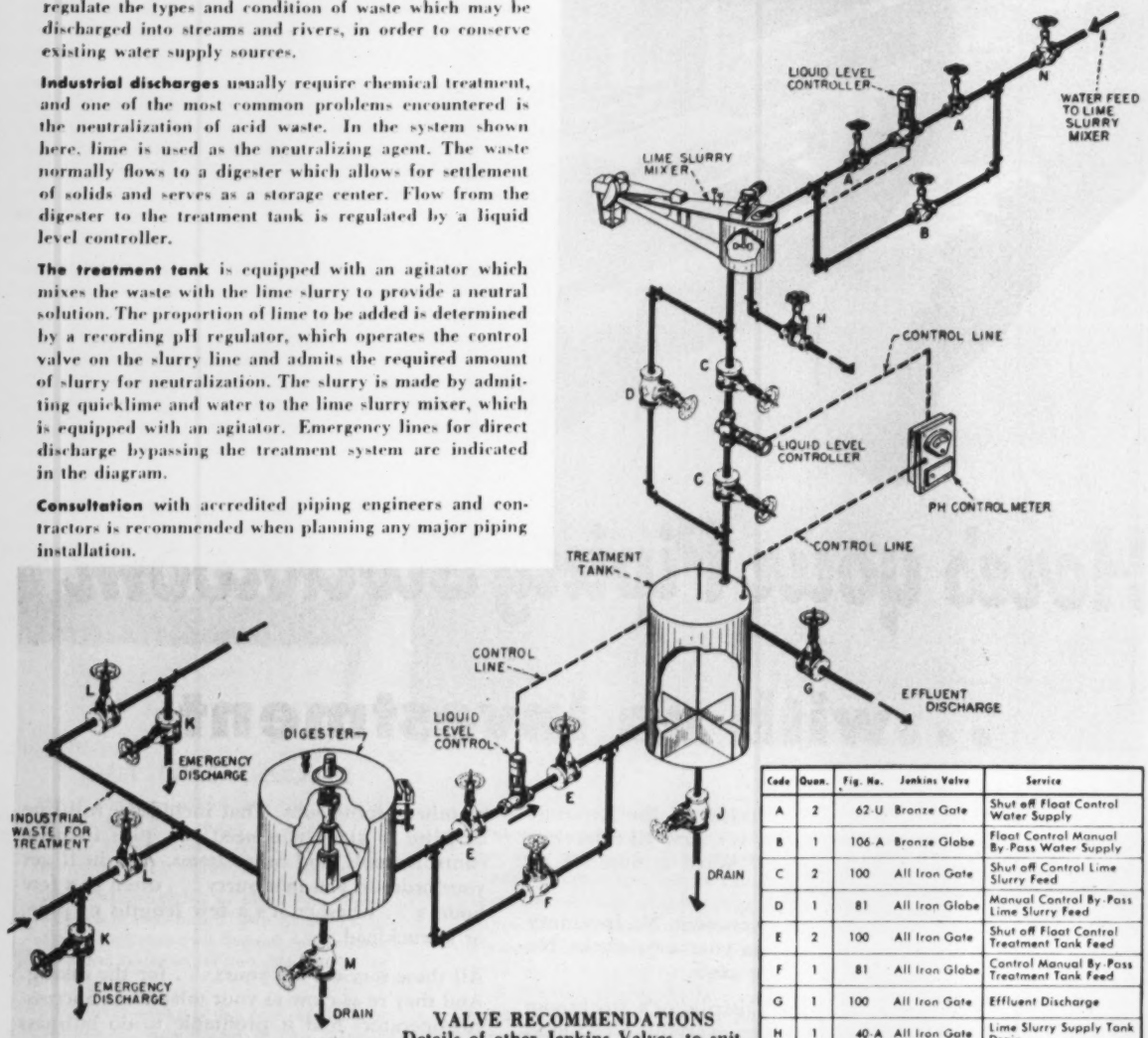


Code	Quan.	Fig. No.	Jenkins Valve	Service
A	2	62-U	Bronze Gate	Shut off Float Control Water Supply
B	1	106-A	Bronze Globe	Float Control Manual By-Pass Water Supply
C	2	100	All Iron Gate	Shut off Control Lime Slurry Feed
D	1	81	All Iron Globe	Manual Control By-Pass Lime Slurry Feed
E	2	100	All Iron Gate	Shut off Float Control Treatment Tank Feed
F	1	81	All Iron Globe	Control Manual By-Pass Treatment Tank Feed
G	1	100	All Iron Gate	Effluent Discharge
H	1	40-A	All Iron Gate	Lime Slurry Supply Tank Drain
J	1	81	All Iron Gate	Treatment Tank Drain
K	4	100	All Iron Gate	Emergency Waste Discharge
L	4	100	All Iron Gate	Shut off Waste Lines
M	1	81	All Iron Globe	Digester Drain

VALVE RECOMMENDATIONS
Details of other Jenkins Valves, to suit varying conditions, available on request.

To simplify planning, to save time, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 70.

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS EVERYWHERE

JENKINS VALVES
LOOK FOR THE DIAMOND MARK

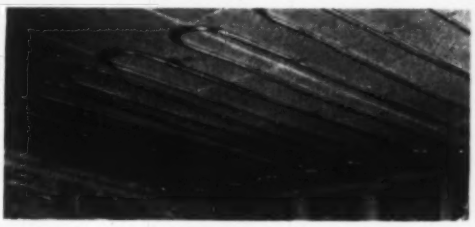
Jenkins Bros

EQUIPMENT DEVELOPMENTS . . .

Add the new products and companies listed here to your Directory Section which you received in your January 1953 Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

Copper Tube Grids for Radiant Heating

*Pre-formed grids of copper tube for radiant panel ceiling heating installations. . . .Known as "PG's," they are made of 3/8 in. Type L copper water tube. Each panel grid contains approximately 50 linear ft. At normal 6 in. spacing along the centerline, the "PG"



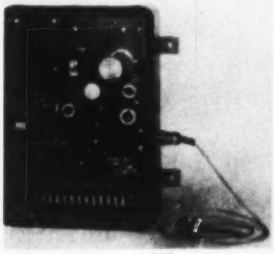
is rated at 1800 Btu. The panel grid is designed so that by contracting or extending it by hand, it can be installed so that the tube spacing meets design requirements. According to the manufacturer, a single grid can serve ceiling areas ranging from 22½ to 60 sq ft.

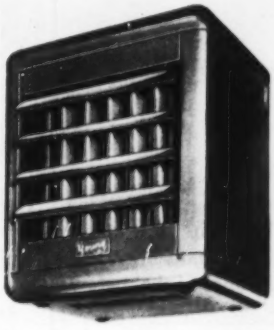
Manufacturer—The American Brass Co., 414 Meadow St., Waterbury 20, Conn.

Gas Fired Unit Heater

*Compact gas fired unit heater 23 in. high with an input of 50,000 Btu per hr. . . .The "G-50", is designed for low ceiling and small space applications. It is direct-fired into tubes of the welded, aluminized steel heat exchanger. Some of the construction features include: draft diverter with built-in side relief openings; electric solenoid gas valve; high temperature limit control; iron burners with drilled ports for use with manufactured, mixed, natural, L.P. or L.P. air gases; fan control; and two-point suspension hangers.

Manufacturer—Young Radiator Co., 709 S. Marquette St., Racine, Wis.





Above: Relay

Right: Heater

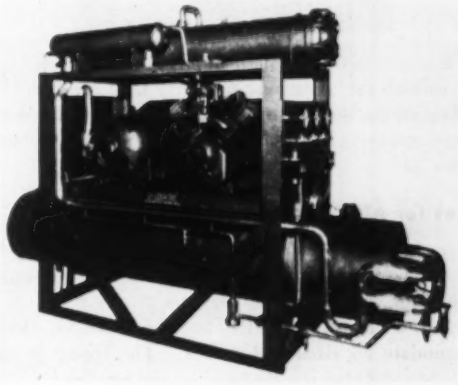
Vibration Relay

Protective device which initiates a signal when excessive vibration due to unbalance occurs in large rotating equipment. . . . The vibration relay is applicable for large motors and blowers. The company states that it has an operating range which allows its use at speeds from 300 to 18,000 rpm to energize warning alarms, corrective or shut-down devices. The vibration relay responds to the output signal of a barium titanate crystal accelerometer which is attached to the equipment to be protected. The signal is amplified through a cathode follower and two-stage amplifier, then rectified by a bridge-type rectifier.

Manufacturer—General Electric Co., 1 River Rd., Schenectady 5, N. Y.

Package Water Chiller

*New line of package water chillers from 5 to 60 hp. . . . The units include compressor, chiller, water cooled condenser, all controls, starter, piping, etc.



completely assembled and ready to start with the connection of power, condensed water and chilled water lines.

Manufacturer—Schnacke, Inc., 1101 N. Governor, Evansville 7, Ind.

Machine for Finned Tubing

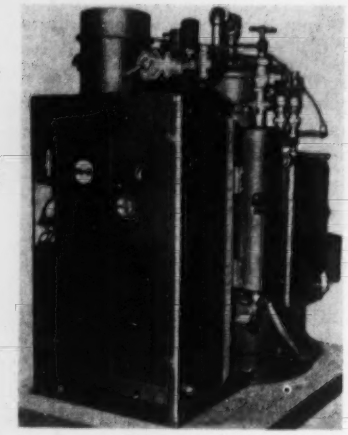
**Ribbing machine said to be capable of producing finned tubes for any application on copper, aluminum, brass and steel. . . . It is designed so that metal tubes are inserted in one end of the machine and the tubes come out at the other end finned and ready for use. It manufactures finned tubes from ¼-in. up to 4-in. diameter stock, for heating, cooling and air conditioning installations.

Manufacturer—United Machinery Sales Co., Dept. PL, 2351 N. St. Louis Ave., Chicago 47.

Steam Generator

"Vapor-Clarkson" steam generator Model OKJ-4740 designed to change from fuel oil to natural gas fuel by flipping a switch and without interrupting steam output. . . . A fuel oil spray nozzle has been incorporated into the metal body of the gas burner. When the fuel selection switch is flipped from natural gas to oil, the

motorized gas valve closes and the fuel oil solenoid valve opens, releasing oil under pressure to the spray nozzle. Fuel oil is continuously circulated through the hydraulic modulating controls. According to the company, it produces 1500 to 5000 lb of steam per hr. Once started, by



turning one switch, automatic controls are designed to take over, causing the steam generator to turn on and off and modulate steam output to meet a changing steam demand.

Manufacturer—Vapor Heating Corp., 4501 W. 16th St., Chicago 23.

Frames for Air Conditioners

Pre-cast concrete frame in wall of building. . . .The frame, which is installed during construction, can be made to fit the specifications of any make of room cooler or a universal frame can be installed that will accommodate all sizes and makes. The frame is said to

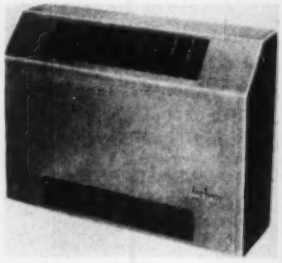
reduce costs when placed in the wall during construction. It can be plastered over if it is not to be used immediately. The plaster can be chipped away at a later date and the air conditioner installed.

Manufacturer—Pre-Cast Corp., 3044 S.W. 28th Lane, Miami 33, Fla.

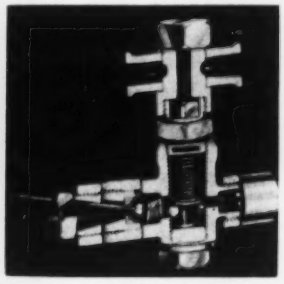
Air Valve with Rod

**All metal "Wobble-Rod" valve with integral exhaust for pneumatically-operated equipment. . . . The lever which opens and closes the valve is a hardened rod swivelled so that the free end can move vertically, laterally, diagonally or in arcs and circles. The manufacturer states that the valve allows lateral play during a vertical throw; permits direct linkage to rotating, oscillating, toggle, lever, slot, or straight thrust mechanisms; it can be adapted to cyclic operation by passing the lever-rod through an eccentric hole in a rotating disc or gear; and it is spring loaded to remain normally open. An internal exhaust valve is designed to automatically discharge an air cylinder, line or receiver when the valve closes. Open valve diameter is ¼ in.

Manufacturer—Pantex Mfg. Co., 521 Roosevelt Ave., Pawtucket, R.I.



Cabinet



Valve

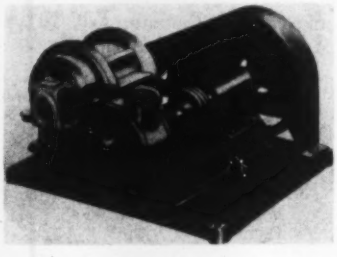
Room Heating and Cooling Cabinets

"Vari-Temp" cabinets designed to heat, cool, ventilate, filter and dehumidify air on a room-by-room basis. . . . The cabinets, which eliminate ductwork, can be floor mounted, vertically wall mounted, mounted flat on ceilings or inverted on walls. They feature two blower fans mounted directly on double-end shaft motors. A manual mixing damper is rubber-cushioned to eliminate vibration. Heating and cooling elements are aluminum fins on copper tubes. End compartments of the cabinet contain all piping and wiring.

Manufacturer—C. A. Dunham Co., 400 W. Madison St., Chicago 6.

Fuel Oil Pump

V-belt drive pump designed to deliver heavy fuel oils at operating pressures up to 100 psi. . . . It has a gear and crescent type pumping element which is said to pump equally well in either direction at 400 rpm. According to the company, the unit can be used for continuous duty pumping of heavy fuel oil without cavitation,

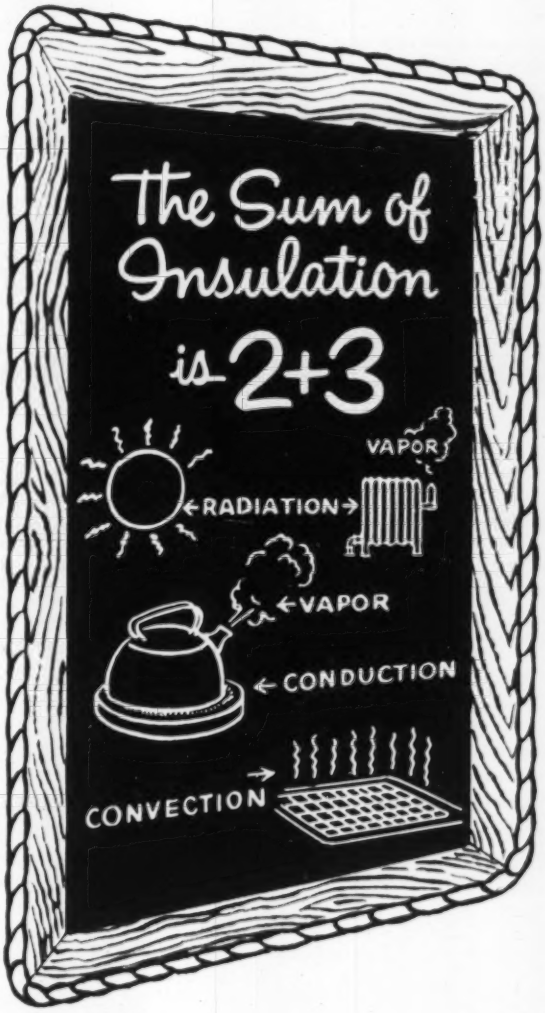


pounding or churning. The V-belt drive is connected to the pump by a loose coupling to prevent side pull on the pump shaft. Belt tension is controlled by adjusting center distance of the motor.

Manufacturer—Eclipse Fuel Engineering Co., 1139 Buchanan St., Rockford, Ill.

Heat-Flow Transducer

Heat-flow measuring instrumentation based on "Model 200" heat-flow transducer to directly drive indicating or recording meters. . . .According to



Five-way protection is required of an insulation against (1) Condensation, (2) Vapor Flow, as well as against Heat Flow by (3) Radiation, (4) Conduction, (5) Convection.

Multiple accordion aluminum provides this 5-fold protection. It is pre-fabricated to automatically create a "blanket" of multiple alternating layers of air, aluminum and fiber as it is installed.

COST OF INFRA INSULATION INSTALLED
in new construction between wood joists, material with labor,

Type 6-Si under 9½¢ sq. ft.
Type 4-Si under 7½¢ sq. ft.
Type 4-S Jr. under 7½¢ sq. ft.

INFRA INSULATION, INC., 525 BROADWAY, NEW YORK, N. Y. Phone WOrth 4-2241

Against (1) Radiation there is high (97%) reflectivity, low (3%) absorptivity and low (3%) emissivity of heat rays. (2) Conduction is low because of preponderant compartmented air spaces of slight density. (3) Convection, outer and inner, is retarded by multiple layers of aluminum and fiber.

The aluminum sheets are completely impervious to water vapor. Infiltration under flat, stapled flanges is slight. The scientific construction of multiple layers of accordion aluminum, fiber and air spaces minimizes condensation on or within this insulation. Its slight mass produces little heat storage.

The new multiple accordion aluminum* Infra Types 6-*Si* and 4-*Si* forms a continuous blanket of uniform thickness between joists, giving the entire area maximum protection against heat loss and condensation formation. Write for samples.

The U. S. National Bureau of Standards has published an informative and authoritative report on "Moisture Condensation in Building Walls." This booklet explains the conditions under which condensation will take place in insulated as well as uninsulated walls; what part is played by effective vapor barriers such as metal foils; how to use and interpret thermal-resistance and vapor-resistance fractions. You can obtain it at our expense by sending us the coupon below.

*Patent applied for

Infra Insulation, Inc., 525 B'way., N. Y. C. Dept. H-11
Please send sample of new insulation ☐; Bureau of Standards Report "Moisture Condensation in Building Walls"—BMS63 ☐; Description of new insulation ☐.

Name_____

Firm_____

Address_____

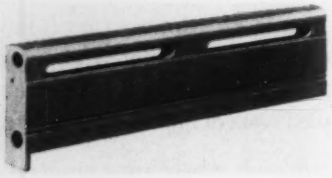
EQUIPMENT DEVELOPMENTS . . .

the manufacturer, this is possible because of the high linear electrical output relative to heat-flow gradient across the transducer. The electrical output results from a large area-density of silver-constantan thermocouple junctions whose output can be connected in various physical and electrical configurations depending upon requirements.

Manufacturer—Beckman & Whitley, Inc., 1002 San Carlos Ave., San Carlos, Calif.

Baseboard Radiation

Two new additions to the "Base-Ray" line. . . .An 18-in. left end section now is in production. This new unit permits furnishing assemblies in increments

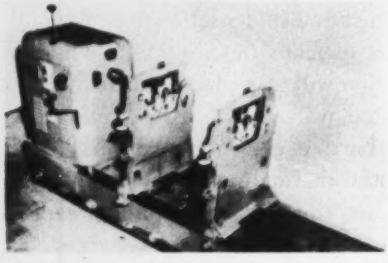


of 6 in. Another new item is the extended corner plate. This is similar to the original corner plate but it has been extended to each side so that it measures 10⅝ in. from the corner to each end. With these two units, the company states, it is possible to cover two or three walls of a room without the use of the baseboard extension.

Manufacturer—The Burnham Corp., Irvington, N.Y.

Balancing Machine

Several new models of "Dy-namic" balancing machines. . . . Machine specifications of Model 353-R include a shaft diameter of range ½ in. to 5 in., weight capacity of 10 to 600 lb, 40 in. swing diameter capacity, and extra bed length in sections of the bolt-on type, the manufacturer states. Other features include automatic and manual pick-up controls for production and

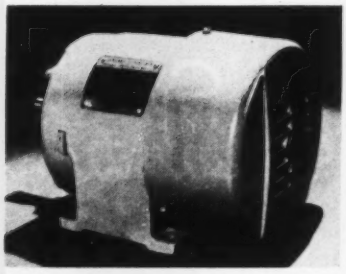


laboratory balancing, dual number drum openings for either vertical or horizontal correction and redesigned flexing head and roller assemblies. Model 345-R features a 30-in. swing diameter capacity and 1 hp motor. Model 375-R-HD features a shaft diameter capacity of 1 in. to 8 in., a weight capacity of 40 to 3500 lb and a 10 hp motor.

Manufacturer—Bear Mfg. Co., Industrial Div., Rock Island, Ill.

Polyphase A-C Motors

New line of polyphase a-c motors, designed to offer better protection, more efficiency and quieter operation. . . .Called "Tri-Clad 55", the new motors are built to the latest NEMA frame dimensions which were reported in the August 1953 HPAC. With an average size reduction of 50 percent by volume and averaging 22 percent less weight per horsepower, the "55" retains



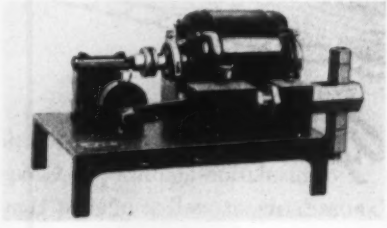
rigid cast-iron construction and incorporates a new insulation system, bearing assembly, and ventilation plan, according to company engineers. Main feature of the insulation system is a new polyester film said to be eight times as strong as previously used materials.

The new motor in 1 to 5 hp sizes is being produced at the company's plant in Fort Wayne, Ind., by the Small Integral Motor Dept. The larger motors will be manufactured in Schenectady by the company's Medium Induction Motor Dept.

Manufacturer—General Electric Co., 1 River Rd., Schenectady, N.Y.

Controlled Volume Pumps

**Controlled volume pump designed to deliver exact quantities of a wide range of liquids regardless of change in discharge pressure. . . .The company states that the pumps will handle abrasive slurries, suspended solids, viscous and corrosive chemicals, light solvents,



liquefied gases, hot, cold and heavy liquids. Delivery quantities range from 3 milliliters per hr to 50 gpm against pressures to 20,000 psi.

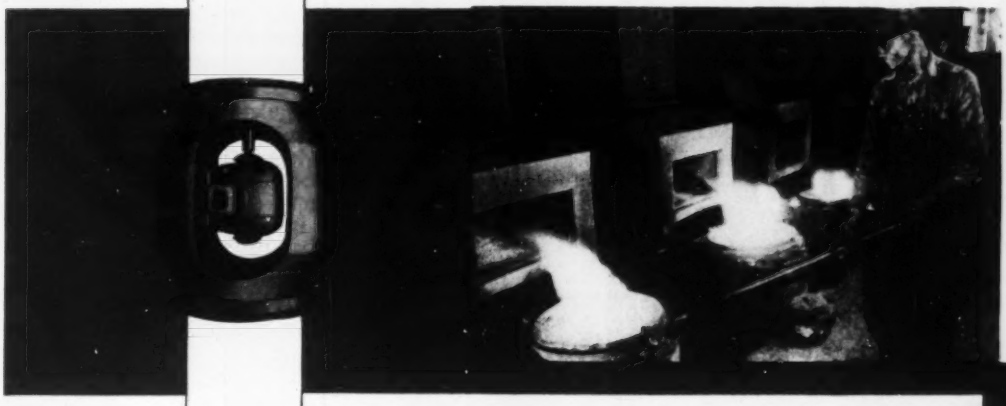
Manufacturer—CC Pump Mfg. Div., Market-Madison Sts., Palmyra, N.J.

Magnet for Electronic Recorder

"Alnico V" magnet for measurement of temperature, pressure, humidity and other variables all at once. . . . The magnet, less than ¼-in. square, is made of nickel, aluminum, cobalt and iron, is magnetized in the process of being heat-treated. It was developed for use with an electronic recorder produced by the Foxboro Co. Its function is to pick off, either at once or in sequence, six differently colored pens so that each pen will be inked by its own pad. It is shaped to hold the pen points in position while the dot is penned on the chart. In operation it uses one chart and one pen arm. An electric signal causes the pen arm magnet to pick up any or all of the

[*Continued on page 226*]

HOW TO EXHAUST FUMES FROM BOILING BRASS . . . WITHOUT HOODS



In brass melting furnaces, normal temperatures run from 1850° to 2350° F. Terrific heat and irritating fumes are given off by these open furnaces.

To improve working conditions around their furnaces, Standard Brass Manufacturing Company of Kansas City, Missouri tried several fan and hood systems without success. Then they installed five DeBothezat Bifurcator Fans, one for each two furnaces. Bifurcators with 27" diameter fan wheels and 2 HP motors, operating at 1140 RPM, were selected. The high velocity of these DeBothezat Bifurcator Fans made it possible to use open ducts behind the furnaces in place of hoods above them.

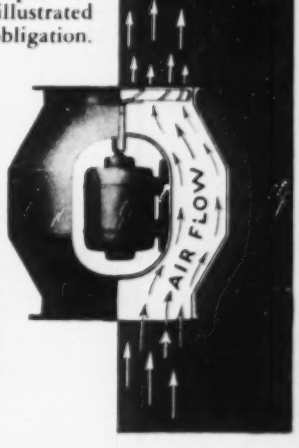
Now working conditions around the furnaces are satisfactory. And furnace charging and unloading is safer, easier and faster *without hoods.*

DeBothezat Bifurcator Fans are ideal for installation where space is limited, because they are compact, and install right in the duct work. Bifurcator Fans can be made of carbon steel, stainless steel, rubber coated steel, monel metal and many other corrosion or heat-resistant materials.

Ask your DeBothezat representative. You'll find him listed in the phone book under "Ventilating Equipment," or write our factory, Dept. HP-1153, for illustrated catalog DB-4-53. Either way, there's no obligation.

HOW BIFURCATOR WORKS

The Bifurcator is a motor driven axial-flow fan in a patented, divided housing. Motor is in an isolated chamber around which flue gases are by-passed (bifurcated) so that the motor always remains cool, clean and accessible. Bifurcators are available in many sizes from 1140 CFM (12" diameter fan with 1/20 HP motor) up to 45,000 CFM (48" diameter fan with 20 HP motor).



DeBothezat Fans

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

Guaranteed TO SHUT TIGHT*

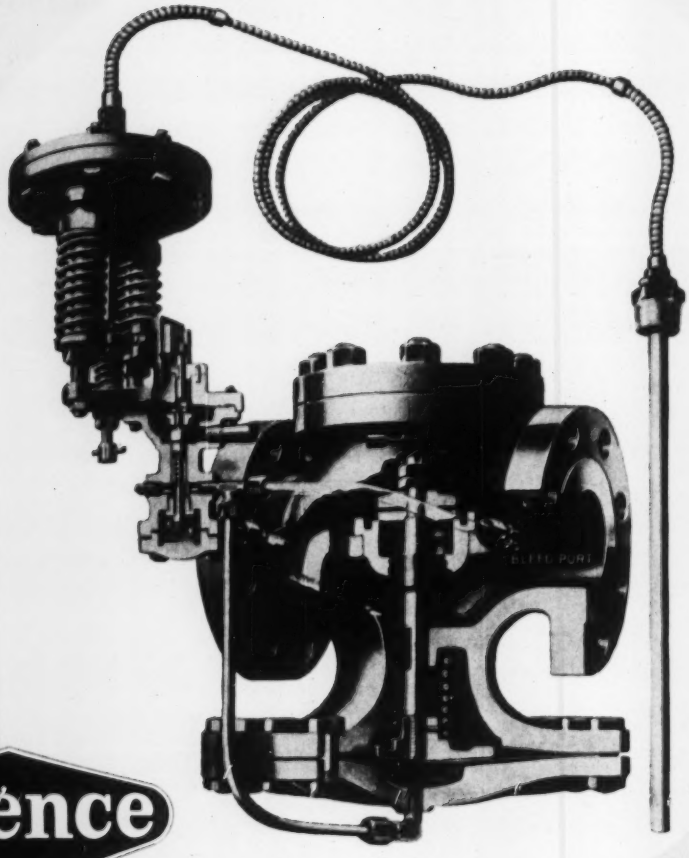
* When equipped with a SECO Metal Seat and Disc on steam service and protected by an approved Strainer, a Spence Regulator is guaranteed to shut tight when the demand for steam ceases.

Expensive steam leaks due to a lack of absolutely tight shutoff are eliminated in Spence Temperature Regulators. Here is why we can make such a guarantee:

First, our temperature regulators are of the single seat design. Seats and discs are made of durable SECO Metal. More than 20 years experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year without requiring expensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.



SPENCE
TYPE ET150
Temperature
Regulator

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

88 189

Peerless BLOWERS

STANDARD OR CUSTOM *Engineered to your requirements*

DIRECT DRIVE

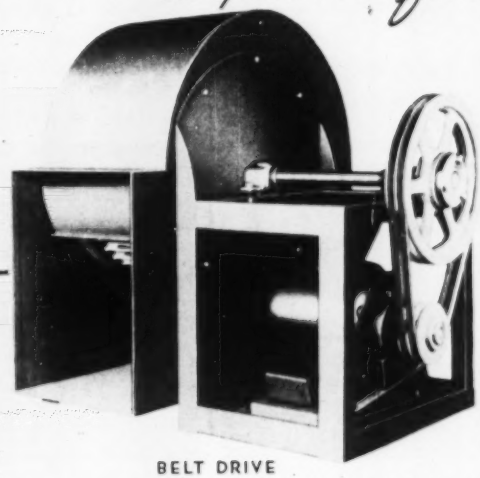
General ventilation and exhaust type for use in boiler rooms, restaurants, washrooms, etc. Motors available for all types of current. Housings constructed of 16-gauge steel.

PRESSURE BLOWER

For exhaust removal of dust or grit, high-pressure conveying, cooling, etc. Blades are dynamically balanced and self-cleaning. Ball-bearing motors. Base and housing of heavy-gauge steel.

ARR. 3-UTILITY BLOWER

Class of construction suitable for ventilation and exhaust systems. Single or double width. Motors and drives available. Vibration base optional.



BELT DRIVE

V-belt with motor pulley adjustable for variety of speeds. Arc welded housings and frames. Clockwise rotation. Bottom horizontal discharge.

Peerless builds a standard line of blowers suited to economical use and installation. Standard features:

ARC WELDED FRAMES AND HOUSINGS,
DYNAMICALLY BALANCED BLOWER,
DUAL GRIP ADJUSTABLE BELT,
CONVERTIBLE DISCHARGE, and
CUSTOM-BUILT PEERLESS MOTOR are easily adapted to most circumstances. When the installation you plan requires special equipment, Peerless designers and engineers will work with you to achieve the result you want. If needs be, Peerless will fly an engineer to your doorstep.

Peerless techniques are flexible. Engineers and designers cooperate with the Peerless Motor Division to create properly matched blowers and motors. They design and build blowers for electronic cooling, conveying, air conditioning, and dust and odor control.

Bring your blower problems to Peerless where they'll be solved quickly, efficiently and economically by men who have 60 years of blower experience on which to draw.

"SMOOTHEST PERFORMERS ON THE MARKET"

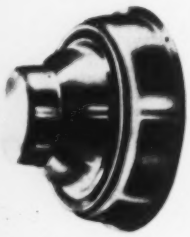
Peerless Electric

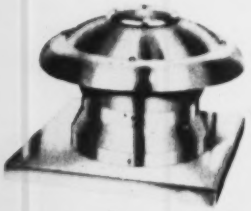
THE PEERLESS ELECTRIC COMPANY
FAN AND BLOWER DIVISION
1409 WEST MARKET ST. · WARREN, OHIO

● Think of it! Premium-quality Jenn-Air ventilating equipment is *completely* weatherproof. Constructed entirely of heavy-gauge aluminum, Jenn-Air requires less maintenance. End painting and repainting costs! Investigate Jenn-Air, *now!*

FOR **WALL** →

Non-Overloading Design—Ball Bearing Motors—Modern Appearance





← FOR **ROOF**

Low Contour—Centrifugal and Axial Types—Explosion Proof and Two-Speed Models

Send for free illustrated brochure, c/o Department C-11

JENN-AIR PRODUCTS CO., INC.

ARCHITECTS & BUILDERS BLDG • INDIANAPOLIS 4, INDIANA

EQUIPMENT DEVELOPMENTS . . .

[*Continued from page 222*]

six pen points and ink the chart according to the impulses received.

Manufacturer—The International Nickel Co., Inc., 67 Wall St., New York 5.

Insulation for Underground Pipes

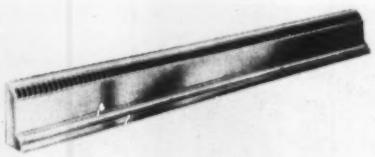
New product for insulating and protecting hot underground pipes from corrosion. . . .Known as "Gilsulate", it is a blend of various sized particles of "Gilsonite." This material is solidified petroleum found in Utah. Applied in three layers, the first layer is poured around the hot underground pipe, melts and is fused to the pipe to provide a semi-plastic coating permitting con-

traction and expansion and thermal and electrical insulation. The second layer of sintered particles provides thermal insulation under wet or dry conditions. Zone three of unconsolidated "Gilsulate" is said to provide thermal insulation and a high load carrying capacity. The company states that the material provides protection against alkaline ground waters, electrolysis, root attacks and bacterial action.

Manufacturer—American Gilsonite Co., 248 S. Main St., Salt Lake City 1, Utah.

Baseboard Perimeter Diffusers

The No. 180 Series diffusers, designed for installation along the baseboard in perimeter heating systems. . . .According to the manufacturer, the units give uniform air distribution without turning vanes or other resistance-increasing devices. The diffusers are available as a single unit or in multiples to form a continuous base-



board along one or more walls. They are designed to blend inconspicuously into the baseline and are suitable for commercial heating and cooling applications. The units consist of two pieces and are installed with a tin snips and screwdriver.

Manufacturer—Air Control Products, Inc., Coopersville, Mich.

.... the BEST BUY for

INCREASED ATTENTION and LASTING SALES POWER

THE JANUARY 1954 ISSUE

and 20th Annual Directory Number of

HEATING, PIPING & AIR CONDITIONING

STANDARD EDITORIAL CONTENT . . . . . .

January HP & AC will be a "regular issue" in every respect. It will carry a full quota of timely articles, and the Journal Section of the American Society of Heating and Ventilating Engineers—the same as in every issue of this field-leading book. For extra attention value, it will have heavy covers, and be specially mailed.

DIRECTORY SECTION . . . .

Every product used in industrial and large building air conditioning, heating and piping will be listed. We'll tell who makes these products and their trade names. All advertisers as they appear in this Directory Section will be prominently identified indicating that more detailed information is elsewhere in the issue. It's the industry's best and most complete BUYING GUIDE—printed on colored stock in a special section.

Here's a regular issue, and a directory issue, combined in one great January number . . . . and *no advance* over regular issue rates!

Here your advertising will get *increased attention*, and have *lasting sales power* (as product reference copy) throughout all of 1954.

Here is the "best buy" of the year in our field . . . . the place where a convincing sales story of your complete facilities will do you untold good.

Here is where *extra* space for *extra* emphasis belongs!

Most advertisers use increased space with us in January—spreads, inserts, color. They catalog their entire lines. You, too, can profit most by doing a complete job. Make space reservation now . . . . we'll be glad to help with copy preparation if needed.

Heating, Piping & Air Conditioning

6 North Michigan Avenue

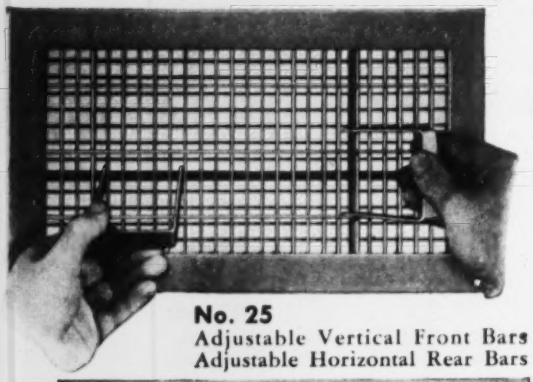
Chicago 2, Illinois

INDEPENDENT

"Fabrikated"

DOUBLE CORE ADJUSTABLE BAR WALL GRILLES AND MULTIPLE VALVE REGISTERS

Each Grille Bar Adjusted Individually



No. 25
Adjustable Vertical Front Bars
Adjustable Horizontal Rear Bars

No. 26
Adjustable Vertical Front Bars
Adjustable Horizontal Rear Bars—with Horizontal Multiple Valves.

Depth with valves closed 1⅛"
Depth with valves open 2¼"

write for new catalog no. 52

MEMBER NATIONAL WARM AIR HEATING INDOOR COMFORT AND AIR CONDITIONING ASSOCIATION

Always Leading • Always Progressing

THE INDEPENDENT REGISTER CO.
3747 E. 93rd STREET • CLEVELAND, OHIO

EQUIPMENT DEVELOPMENTS . . .

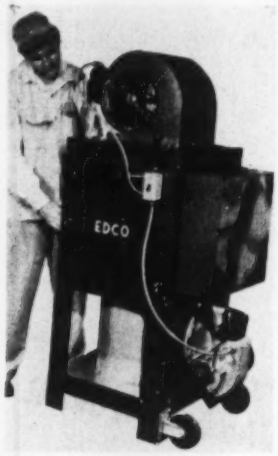
Vaneaxial Blower for High Temperatures

A vaneaxial blower designed to move air at temperatures up to 350 F or air containing acids, alkalies or fine abrasive dust. . . .A modification of the firm's belt-drive model, the new high temperature blower is available in the same range of sizes—12 in. to 54 in. On the new blower, the addition of a special dummy section containing the guide vanes makes possible the location of the drive on the negative side of the blower. With this arrangement, clean air from outside the duct is drawn in through the belt tube and over the bearings.

Manufacturer—Hartzell Propeller Fan Co., Piqua, Ohio.

Portable Oil Fired Heater

***"Edco" portable oil fired heater for hard o heat spots, pre-heating, thawing, drying etc. . . . Self-ontained, it operates on kerosene or No. 1 fuel oil and is lesigned to produce 190,000 Btu's per hr. According to he manufacturer, installation of a vent, flue or chimney is

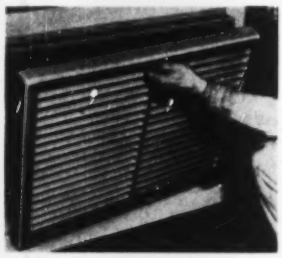


not required. It plugs in to 110-115 volt, a-c electrical urrent. A blower on the top of the heater draws in air nd forces it down and over a heat exchanger where it is down out through openings in three of the lower sides.

Distributed by—Cauhorn Distributing Co., 9999 Broad-treet, Detroit 4.

Wall Heater

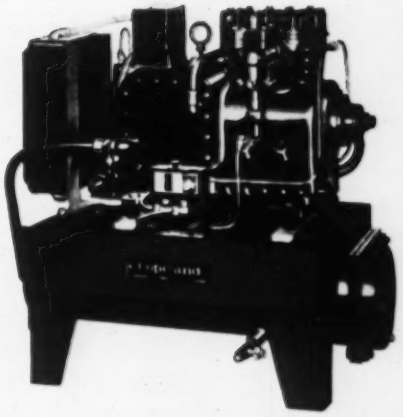
***"ThermoRay" electric wall heater which emits radiant heat and creates a flow of warm air. . .One of its features is an asbestos composition heating



panel. The manufacturer states that maximum heat trans-fer is provided because of the uniformity of heat distribu-tion. The heater is a permanent unit which attaches to or

COPELAMETIC

THE *Accessible* HERMETIC



fits into any air conditioning plan

Cutaway of 7½ H.P. COPELAMETIC Motor-compressor

Whether it's a room air conditioner, a large package unit or a huge factory system, COPELAMETIC is your answer to the question "Which refrigeration unit shall I recommend for the air conditioning system?" COPELAMETIC has become the standard of comparison for dependability, ruggedness, compactness and long life. Your clients will appreciate the COPELAMETIC design which eliminates belts, seals and manual oiling . . . reasons for 9 out of 10 service calls. Better yet, they'll appreciate the practical feature of accessibility.

Air-cooled, remote COPELAMETICS are built from ¼ thru 3 HP. There are also water-cooled, remote units from ⅓ thru 7½ HP. Self-contained COPELAMETICS are available for all applications. Write for Condensed Catalog C-52.

REFRIGERATION UNITS (OPEN TYPE AND COPELAMETIC) WATER COOLERS

Copeland

DEPENDABLE *Electric* REFRIGERATION

COPELAND REFRIGERATION CORPORATION, SIDNEY, OHIO

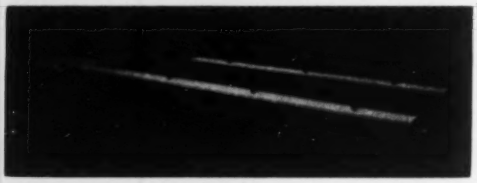
EQUIPMENT DEVELOPMENTS . . .

recesses into the wall. They are reported to have a low initial inrush of electricity and are available in wattage ratings of 750 and 1250 for operation on 115 or 230 volts.

Manufacturer—ThermoRay Corp., 141 E. 44th St., New York 17.

Vibration Isolation Bases

Mounting bases to cut transmission of fan, motor and compressor vibration to floors and walls. . . . "Barrymounts" are designed to carry the weight and to match the vibration characteristics of the installation. The



unit is held between steel members that run the full length of the machine. A motor-mounting plate is incorporated in one member to keep the motor and fan pulleys the same distance apart for steady drive and reduced belt wear.

Manufacturer—Barry Corp., 832 Pleasant St., Watertown, Mass.

Gas Fired Unit Heaters

*New line of gas fired unit heaters for automatic, direct-fired heating of industrial and commercial areas. . . .The heaters are made in eight models in capacities from 20,000 to 160,000 Btu per hr. They can be used with natural, manufactured, mixed or L.P. gases. Motor driven fans range from 1/40 to 1/6 hp. The fans are designed to operate with a minimum of noise. Louvers

are individually adjustable. Safety against the danger of escaping gas is provided by an automatic safety pilot which operates to shut off the gas supply if the pilot burner goes out.

Manufacturer—Grinnell Co., Inc., 260 W. Exchange St., Providence 1, R.I.

Transformer Replacement Kit

**Ignition transformer replacement kit for servicemen. . . .The company states that it is applicable for almost all standard oil burners. The kit contains two standard transformers, three interchangeable mounting bases, eight fastening screws, two studs for stud mounted transformers, two rajah adapters and two spring clip

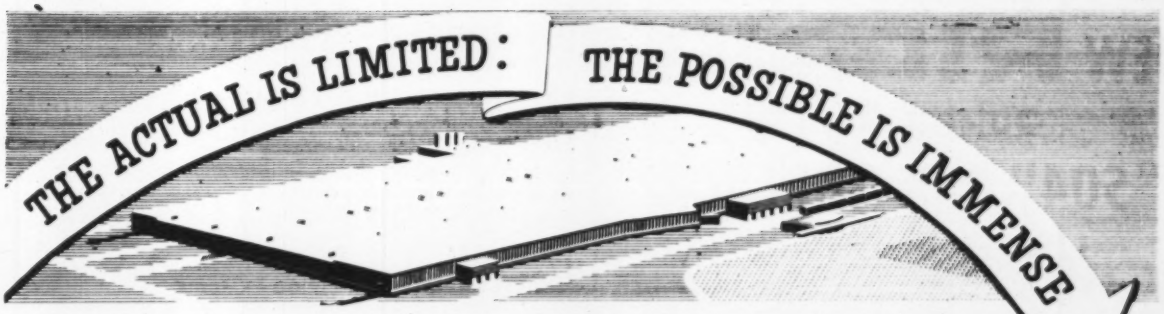
ELECTRO
Extra
DYNAMIC
ependable industrial motors

E.D. motors are engineered for *silent* operation with special slot design, dynamic balancing and scientific bearing assembly.

FOR QUIETER OPERATION . . . Over half a century of building motors for "the silent service" to power and air-condition U. S. submarines has given Electro Dynamic an unequalled experience in producing motors for installations where SILENCE is a primary consideration.

WRITE TODAY FOR CATALOGUE NO. 1181

ELECTRO DYNAMIC
DIVISION OF GENERAL DYNAMICS CORPORATION
BAYONNE, NEW JERSEY



NEW LINCOLN PLANT CREATED BY INCENTIVE INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

© LE Co. 1953

SHIELD ARC'S RIGHT TYPE ARC . . . RIGHT ARC INTENSITY

simplifies pipe installations, cuts costs

MORE Lincoln "Shield-Arcs" are used on piping jobs than any other welder today. And for good reason:

Whether it's flat, vertical or overhead work, top quality welding is easier with "Shield-Arc". Through the Job Selector, the operator sets the *right type* of arc. With the Current Control he sets the right arc intensity. Unlimited combinations instantly available with *Lincoln Dual Control* match the exact welding needs of every job for efficient operation.

Result . . . Each weld produced with "Shield-Arc" has dependable top quality, is made faster . . . at less cost per inch.

Fig. 4. Welds High Pressure Pipe *on refrigeration system for multi-story plant. 12" pipe, bevelled 60° and welded with three passes of Lincoln "Fleetweld 5" electrodes, forms permanent, trouble-free installations.*

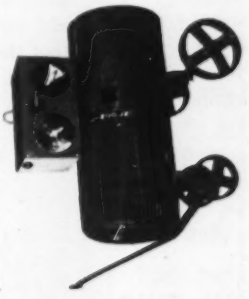


Fig. 3. Top Performer. *Lincoln "Shield-Arc" SAE motor driven welder with Self-Indicating Dual Continuous Control. Preferred by contractors and arc welders the world over for fast, easy, low cost performance.*

HOW LINCOLN SAE WELDER SAVES MONEY SAVES TIME CUTS PIPING COSTS

Fig. 1. Simplifies and Speeds Construction *of 8" vertical exhaust line from warm water tank. Joints are bevelled 60° to assure 100% penetration. "Fish-mouth" ends of 4" pipe are laid out to fit contour of 8" pipe by template method before fillet welding with Lincoln "Fleetweld 5".*

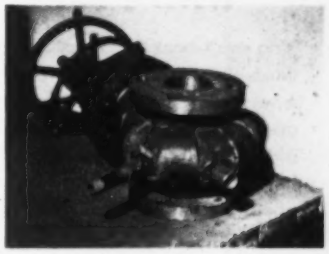


Fig. 2. Adds Steam Jacket *to valve for industrial processing. Jacket is formed by slicing 8" pipe and coping out vee sections before bending and welding with Lincoln "Fleetweld 5".*

HERE'S HOW

GET THE FACTS—Details on cutting welding costs with "Shield-Arc" are in Bulletin 1302. Write on your letterhead to Dept. 3803.

THE LINCOLN ELECTRIC COMPANY

Cleveland 17, Ohio

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

NEW RIDGID

Quick-Opening "504" PIPE THREADER

for Power Drive use

Threads 1" to 2" pipe with 1 set of dies

You can't beat this new "504" for fast smooth threading with power drive! Changes instantly from size to size regardless of position of quick-opening lever . . . Release ball handle, move indicator line to 1", 1¼", 1½" or 2" on size bar, tighten—it's ready to thread! Quick-opening handle retracts dies instantly without stopping power drive—no slow backing off. 4-jaw workholder centers pipe for accurate threading. No lead screw to jam. Easy-to-read size bar. Adjustable to over and under size threads. See it . . . try it . . . buy the new "504" at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

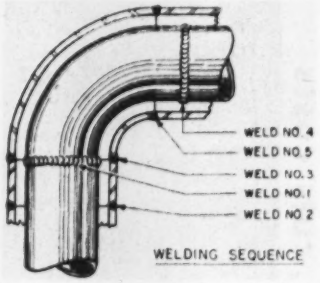
EQUIPMENT DEVELOPMENTS . . .

adapters. It is designed so that a transformer replacement can be completed in one operation. Standard 115 volt primary and 10,000 volt secondary transformers are provided with four knockouts for the internal junction box on sides, end and bottom.

Manufacturer—Magnex Corp., 90-28 Van Wyck Expressway, Jamaica 18, N.Y.

Fittings for Jacketed Piping Systems

Fabrication procedure to employ welding fittings for directional changes in jacketed piping systems. . . . The jacketed fitting combination consists of long and short radius 90 deg elbows, with their center line radii closely matching. On one end of the inside elbow is a tangent that extends beyond the corresponding end of the outside elbow. On the other end of the inside elbow

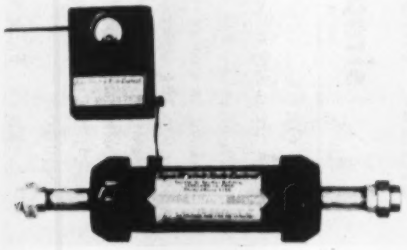


a short piece of pipe is attached to facilitate the installation work. Advantages claimed by the manufacturer include: elimination of the need for steam or coolant jumpers; elimination of flanged joints, except where piping must be disassembled; more accurate temperature control; minimizes thermal expansion and contraction problems; optimum flow conditions; insulation can be readily applied; and reduction of maintenance costs.

Manufacturer—Tube Turns, Inc., 221 E. Broadway, Louisville 1, Ky.

Scale Control Unit

Electric scale control unit to reduce and prevent hard scale formation in boilers, heat exchangers, air conditioning systems etc. . . . The company states that the unit creates a physical change in the water-borne particles and salts which cause scale conditions. By passing the water through an electrical field of the proper intensity, the colloidal particles and dissolved salts act as a conducting medium picking up an electrical charge in proportion to the electrical conductivity of the water. The particles in the water then are not attracted to metal surfaces. The unit consists of a laminated plastic cylinder which houses the electrodes and through which the water



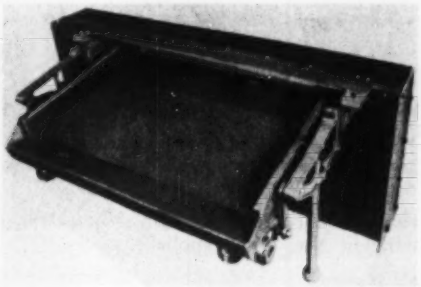
EQUIPMENT DEVELOPMENTS . . .

flows and a plastic control box containing electrical apparatus to regulate the treatment of the water.

Manufacturer—Aqua Electric Scale Control Inc., 2028 E. 22nd St., Cleveland 15.

Industrial Anthracite Burner

**Industrial anthracite burner to convert existing steam and hot water boilers to automatic firing. . . . Known as the "Fire-Jet," the unit is designed for steel or cast iron boilers. Any standard grade of anthracite may be used. Circulation of the water through the burner to the boiler is said to increase heat output. The



unit consists of a burner installed inside the boiler and gravity-fed with coal from a hopper located on the outside. A standard 1750 rpm motor drives a fan which forces air through the tuyeres in the burner and supplies power for the mechanism which oscillates the burner periodically and distributes the coal evenly over the fire-bed surface.

Manufacturer—Electric Furnace-Man Inc., Emmaus, Pa.

Connection for Air Powered Tools

"Quick Detachable" air connection to provide free flow of air to air powered tools. . . .The manufacturer claims that the pressure drop at the connection is cut to 5 percent. Another feature is that it has a 360 deg swivel action, so that the tool can be rotated on the

base to bring it into position. The connection consists of a male member that threads onto the air inlet of the tool and a female member that attaches to the air hose and consists of a sleeve with a sliding collar.

Manufacturer—Binks Mfg. Co., 3122 Carroll Ave., Chicago 12.

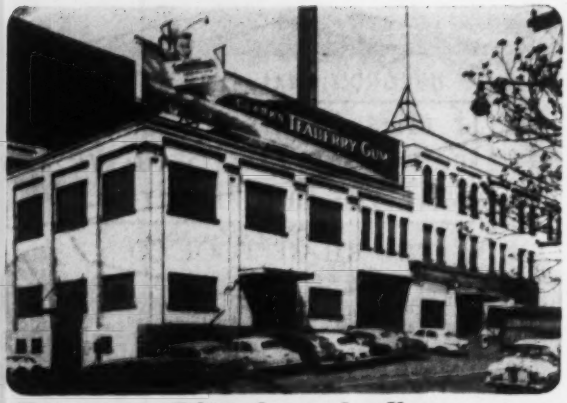
Bronze Industrial Pump

Industrial pump with scoop rotor and rubber roller-type vanes, designed for production in bronze to meet continuous water recirculation requirements. . . . "Model 4300" has sealed, permanently lubricated ball

Guarantee that has saved money for millions of users for 30 years

- ★ Housing Guarantee is specific, instant make-good, no argument.
- ★ No-slip no-lock replaceable jaws, handy pipe scale on hookjaw.
- ★ Adjusting nut that spins easily to size, 6" to 60".
- ★ Comfort-grip I-beam handle.
- ★ 100% factory pipe testing of every wrench!
- ★ Always the most for your money! Buy RIDGID's at your Supply House.

THE RIDGE TOOL CO. • ELYRIA, OHIO



Famous Pittsburgh firm uses

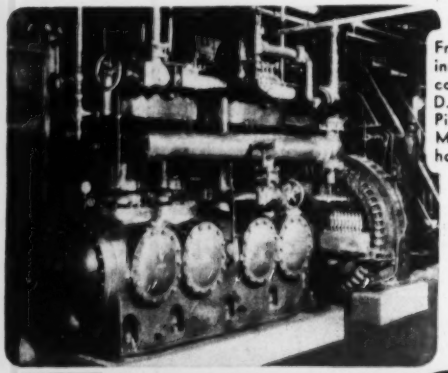
Frick Refrigeration

35 years, and finds it very dependable

The D. L. Clark Company, manufacturers of the world famous Clark Bar, and Clark Brothers Chewing Gum Company now operate eight large Frick refrigerating machines in their Pittsburgh Plants. The first of these compressors, installed in 1918, is still in service. Other Frick equipment includes condensers, coolers and controls.

Today, Clark Bars and Clark's Teaberry Gum are famous the world over. Frick air conditioning and cold storage systems play a vital part in maintaining the quality of all Clark products.

There's hardly a business that cannot profit from the use of similar Frick cooling equipment. Let us quote on the system YOU need.



Frick 4-cylinder ammonia compressor at D. L. Clark Co., Pittsburgh. Motor has 300 horsepower.

DEPENDABLE REFRIGERATION SINCE 1882

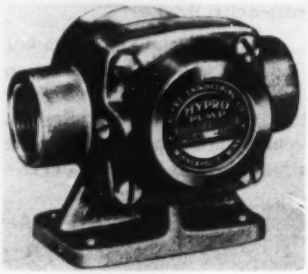
FRICK CO.

WAYNESBORO, PENNA. U.S.A.

Also Builders of Power Farming and Sawmill Machinery

EQUIPMENT DEVELOPMENTS . . .

bearings, the company states. Another feature is a pressed fit of the stainless steel shaft into the inner ball bearing race to restrict lateral movement of the rotor. The pump impeller is self-lubricated by water and is said to deliver

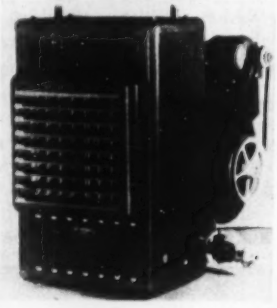


approximately 7 gpm at 50 lb pressure and 1750 rpm. Pressure range is from 0 to 75 psi. The pump is furnished with ¾-in. ports, and recommended speeds are up to 1800 rpm.

Manufacturer—Hypro Engineering, Inc., Dept. KP, 404 N. Washington Ave., Minneapolis 1.

Gas Unit Heater

Blower-type model with steel heat exchangers and dual-directional air distribution louvers. . . . Other features include electrically welded tubes and com-



bustion chamber, stainless steel ribbon burners, cushion mounted blower motor with thermal overload protection and a draft hood built into the heater. It can be used with natural, manufactured and LP gases. Models are available from 75,000 to 200,000 Btu input capacity.

Manufacturer—Hastings Air Conditioning Co. Sales Div., Hastings Air Control, Inc., 3215 Leavenworth, Omaha, Neb.

Insulated Roofing Material

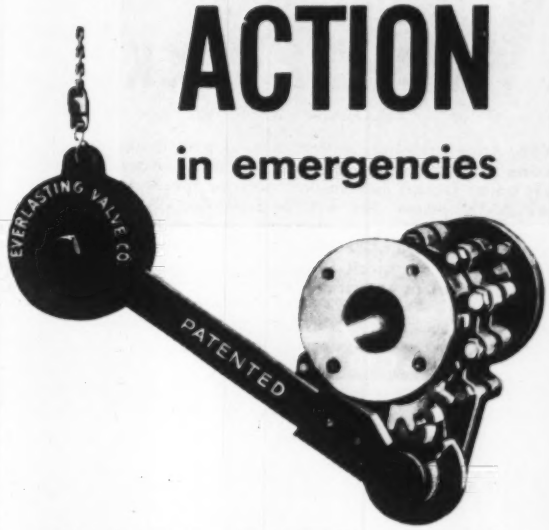
**Roof decks made of wood fibers, chemically treated and bonded with a mineral binder under heat and pressure. . . .According to the manufacturer, the roof decks are strong, lightweight, non-combustible, provide thermal insulation, noise reduction and light reflectivity. The decks weigh 2 lb per board ft.

Manufacturer—Tectum Corp., 105 S. Sixth St., Newark, Ohio.

Gas Flowmeter

***"Model 30 Vol-O-Flo", dial indicating gas flowmeter. . . .It consists of a differential pressure gage across a linear pressure drop flow element. It is de-

For dependably QUICK ACTION in emergencies



These Everlasting Valves, weight-operated with pendulum stop, assure immediate, positive and unfailing response the instant the weight is released. Their design prevents sticking, binding or wedging, and provides full unimpeded flow when open.

Control can be thermostatic, electric or manual, from any or many locations; and two types are available:

Closing Type (as illustrated)—for emergency shut-off of inflammable liquids, or to concentrate water or steam in fire mains.

Opening Type—for diversion of water to sprinkler deluge or water curtain systems, or to divert inflammable liquids to a safe point.

These valves are widely used for fuel oil shut-off, dip tank discharge, foam and other emergency protection systems. Write for full details.

EVERLASTING VALVE CO., 49 Fisk St., Jersey City 5, N. J.
Trade Mark "EVERLASTING" Reg. U.S. Pat. Off. EV-3688A

Everlasting Valves

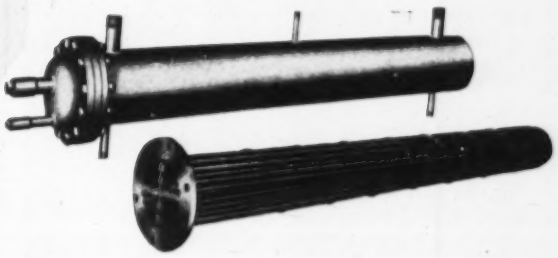
for everlasting protection

BETTER COOLING WITH

Taco

"CONTROLLED VELOCITY" CHILLERS

1. Improved heat transfer
2. Rapid response to Thermal Expansion Valve
3. No oil logging and slop over



Because . . .

TACO'S "CONTROLLED VELOCITY" TUBE BUNDLES

Carry *all* incoming liquid to the top of the Chiller in the first pass.

Provide constant forward movement of *all* refrigerant and oil.

Prevent accumulation of liquid (refrigerant or oil) in any part of the Chiller.

And because . . .

TACO'S "CONTROLLED VELOCITY" HEADS . . .

Agitate oil and liquid refrigerant, at each head pass, with a constant stream of expanding gas.

Provide unretarded flow of refrigerant.

Eliminate "traps" for oil and liquid refrigerant

For full information and Taco's "pin-point" Selection Charts, write for Bulletin CWF.

Taco

TACO HEATERS INCORPORATED
137 South Street Providence 3, R. I.

SPACE HEATERS BEAT W'HSE HEATING PROBLEM

Over 100,000 square feet heated by four 1,000,000 BTU National Champion direct-fired Heaters.

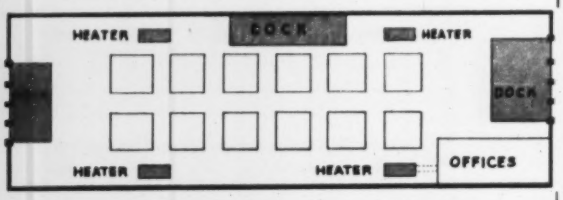
Interior shipping docks and large storage areas present a warehouse heating problem to many factory engineers and owners, according to George T. Costello, secretary-treasurer of the National Heater Company, Inc., national manufacturers of oil, gas and combination oil-gas direct-fired heating equipment with headquarters in St. Paul, Minnesota.

"Take a typical warehouse problem," Costello said. "A firm, specializing in the manufacturing of warm air heating equipment, required 65 degrees in its No. 2 warehouse throughout the heating seasons.

Each end of the 161' by 650', one-story building, north and south, has four electrically operated dock doors, sufficiently large," Costello stated, "to accommodate semi-trailers 34' long. The east wall has two dock doors for direct loading and unloading of railroad cars. Doors are opened on the average of one or more every 15 minutes."

This was the problem! Not too different from problems of other manufacturers with large areas to heat. Solution —the installation of four 1,000,000 BTU, Model "H" National Champion heaters.

The heaters were placed against the east-west walls, directly in line with one another, and are approximately 100 ft. in from the north and south loading docks. Three serve entirely as space heaters, distribution being provided by high velocity air discharge through adjustable grilles. One heater handles the area around it and office space in the corner. The firm reports complete satisfaction with the economy and performance of this system and its ability to maintain a consistent, even temperature over the entire floor area.



This case is just one in thousands that proves "There's a National Champion direct-fired Heater to meet most any heating requirement."

National Champion equipment, heavy and light oil series has been listed by Underwriters' Laboratories, Inc. and meets requirements for safety both from the standpoint of electrical control sequence and the safe firebox surface and casing temperature to qualify on minimum clearance.

Designed for large area heating, National Champion units are produced in 12 models with capacities ranging from 200,000 to 2,000,000 BTU per hour.

Information and specifications are available upon request from the National Heater Company, Dept. A, 2184 Cleora Avenue, St. Paul 4, Minn.

NATIONAL HEATER COMPANY, INC.

2184 Cleora Avenue **St. Paul 4, Minnesota**

CUSTOM BUILT— QUANTITY PRICED

atlas BOILER JACKETS

YES, Atlas combines highest quality with lower costs by using basic styles and eliminating tooling costs. You can get boiler jackets custom built to your specifications from ATLAS at prices that will surprise you. ATLAS offers three flush type boiler jacket styles to meet manufacturers' demands. All are of heavy gauge steel, with baked enamel finish, ready for quick installation. You'll find them all the last word in appearance and value.

ECONOMY

Square type construction is featured in this model. In spite of its fine appearance Economy is competitive in price. Ideal for large scale housing projects where price is a major factor.

QUALITY

The richness of the round-cornered top is combined with the simplicity and economy of the square-cornered body. This style is competitive in price with all standard construction designs.

DELUXE

This fully round-cornered design is Deluxe in every way. The full radius on all corners lends massiveness and beauty to its expensive appearance. Use Deluxe for your select dealer trade at surprisingly low cost.

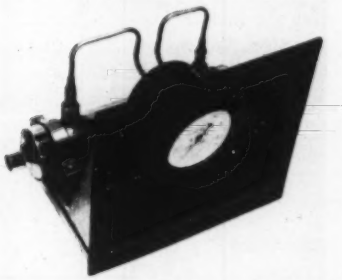
Atlas also manufactures cabinets for heating, cooling and air conditioning units, and furnace cabinets of any style. We will be glad to quote cost estimates on any type of boiler jacket or cabinet on receipt of your specifications and requirements.

Atlas MANUFACTURING COMPANY

EUSTIS AT ROBBINS ST. • ST. PAUL 4, MINN.

EQUIPMENT DEVELOPMENTS . . .

signed for measuring the rate of flow of gases at pressures up to 20 psi. For vacuum service, the company states that it is operable to absolute pressures down to ½ psi. Neither the flow element nor the indicator is said to require



levelling. The use of a mechanical differential pressure gage reportedly makes it possible to operate the flowmeter from −60 F to 180 F. Full scale flow ranges are available from 0.003 to 30 cfm for most gases.

Manufacturer—National Instrument Laboratories, Inc., 6108 Rhode Island Ave., Riverdale, Md.

EQUIPMENT BRIEFS . . .

HAND PUMP to blow or suck out sludge in oil lines. . . . According to the company, the pump can also be used for priming and testing lines and can handle air and most liquids. Suction and pressure side terminate in two tight oil check valves.

Manufacturer—Hold-Tite Valve Mfg. Co., 550 Fifth Ave., New York 36.

MOLECULAR VACUUM GAGE to measure pressures without external detectors. . . .The instrument is available in two types, both covering the range of 0-20 mm of dry air. One is calibrated directly for dry air and the other has a linear scale for use where individual calibration for dry air or other gases is preferred.

Manufacturer—General Electric Co., 1 River Rd., Schenectady 5, N.Y.

PROPANE TORCH small enough to be carried in a tool kit. . . . The "Bernz-O-Matic Bantam" is 7 in. long and is said to be instant lighting at any temperature down to −30 F. According to the manufacturer, the flame develops a temperature of 2300 F.

Manufacturer—Otto Bernz Co., Inc., 280 Lyell Ave., Rochester 6, N.Y.

METAL WORKING ELECTRODE for quick heating, annealing, heat treating, softening, etc. . . .."ThermoTrode" is not for welding but as a source of instant heat. It is inserted in an ordinary electrode holder of a d-c arc welder.

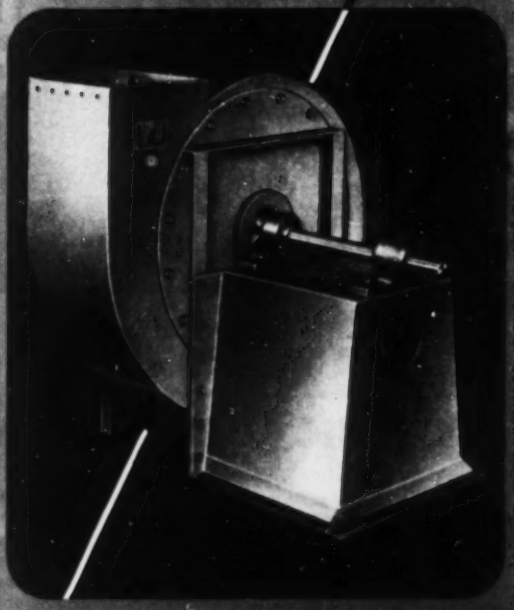
Manufacturer—Eutectic Welding Alloys Corp., Dept. P, 172nd St. and Northern Blvd., Flushing, N.Y.

SELF-FILTERING HOOD for buffing and polishing wheels and belts. . . .According to the company, dust is withdrawn and controlled by the wind created by the revolving buffing or polishing wheel or belt. Known as the "Elim-O-Dust," the hood is designed to remove minute amounts of dust and dirt down to 0.02 microns in size.

Manufacturer—Slonneger Products Co., 1524 Milburn Ave., Dayton 4, Ohio.

ALADDIN

FANS



Type "EX"

INDUSTRIAL

EXHAUSTERS

• RUGGED

• EFFICIENT

• DEPENDABLE

ALADDIN Industrial Exhaust Fans are ruggedly built and are especially suited for material handling or fume exhaust applications. They are ideal for removing dust from grinding wheels, conveying materials such as grains, shavings, sawdust, or the removing or handling of fumes, hot air or gases.

Units are all-welded steel plate construction . . . and are available with interchangeable "AR" Air Rotors, "MR" Material Rotors or "OR" Open Rotors.

WRITE FOR COMPLETE DATA

ALADDIN HEATING CORPORATION

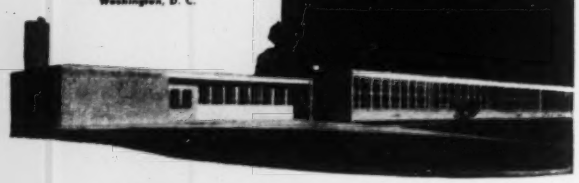
2272 SAN PABLO AVE., OAKLAND 12, CALIFORNIA

REPRESENTATIVES IN ALL PRINCIPAL CITIES IN THE WEST

COMPACT
EFFICIENT
DEPENDABLE

FOR MODERN SCHOOL HEATING

Hillendale Elementary School
Montgomery County, Maryland
McLeod & Ferrara, Architects
Washington, D. C.



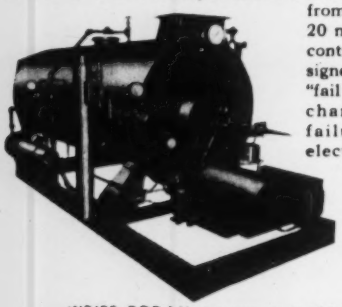
CYCLOTHERM*

CYCLONIC COMBUSTION

COMPACT . . . No extensive stack, foundation, insulation, excavation or instrumentation is required. Cyclotherm Units are delivered complete, the Contractor sets the boiler on the spot you choose and makes five easy connections; fuel, electricity, water, steam and a simple flue to comply with local codes. The Cyclotherm is the smallest fire tube boiler available for its rated capacity, which provides the architect maximum use of space.

EFFICIENT . . . The efficiency of any boiler is determined by the rate of heat transfer from fuel to useful heat. The superior advantage of a Cyclotherm Unit is due to the increased transfer of heat by radiation of the flame, the characteristic of which is controlled by Cyclonic Combustion, a patented combustion method used in Cyclotherm Units which allows a guaranteed minimum efficiency of 80% and low fuel consumption.

DEPENDABLE . . . Cyclotherm boilers give you full power from a cold start in 15 to 20 minutes. The electronic control system is so designed that the boiler will "fail safe" in case of mechanical breakdown or failure of fuel, water or electricity. Local factory trained engineers are always ready to give you immediate service and keep your boiler running smoothly.



WRITE TODAY for your copy of "All Your Questions Are Answered by Cyclotherm" and find out why Cyclotherm Steam Generators have been proven superior in thousands of installations. Just drop a post card to Cyclotherm, Dept. 26, Oswego, New York.

*Reg. trade name

CYCLOTHERM
STEAM GENERATORS

CYCLOTHERM DIVISION UNITED STATES RADIATOR CORP. — OSWEGO, NEW YORK

RECENT TRADE LITERATURE . .

Clip Punch for Sheet Metal

Data sheet describes "Universal" clip punch. According to the manufacturer, the action of closing and opening the handles punches through three sheets of 20 gage mild steel, flattens out the lug and squeezes the metal together as if riveted. The company recommends it for use in the air conditioning and metal fabricating field for use on duct work, standing seams, etc. A detailed drawing of the punch is shown on the data sheet.

Manufacturer—Thor Tool and Die Co., 865 Estabrook St., San Leandro, Calif.

Copper Water Tube

Catalog BC-1 contains complete information on firm's line of copper water tube. In addition to the product information, there is a technical section giving design and installation data to help in the selection and application of copper water tube.

Manufacturer—Triangle Conduit & Cable Co., Inc., Brass and Copper Tube Div., New Brunswick, N.J.

Dial Thermometers

Bulletin 467 on dial thermometers for long distance measurement, provides data on temperature indicators of the vapor pressure and gas pressure types. One section gives details of construction. Another section is devoted to bulbs, tubing and accessories. Dimensions and bulb lengths are given for plain and union type bulbs, with bendable and rigid necks. Five types of connecting tubing are illustrated in addition to descriptions of bushings, sockets and flanges. Diagrams show suggested installation methods, covering cookers, retorts, kettles and pipelines.

Manufacturer—The Foxboro Co., Foxboro, Mass.

Electric Testing Instruments

Bulletin GEA-5469B is a buyer's guide on electric testing instruments. Included is data on such instruments as hook-on volt-ammeters, hook-on wattmeters, hook-on power-factor meters, portable recorders, voltmeters and ammeters, phase-sequence indicators, hand pyrometers, surface roughness scales, insulation-resistance meters and others. Application data, features of each instrument and prices are included.

Manufacturer—General Electric Co., 1 River Rd. Schenectady 5, N.Y.

Electrical Resistors

Four technical data sheets include information on methods of using "Thermistors," heat sensitive electrical resistors with negative temperature coefficients, as well as a description of a new physical demonstration of permanent magnet properties. The reports describe applications in radio set surge protection, data sheet TH-11; contactless switches in overload protective devices, TH-11; temperature compensation, TH-10; warning signals, TH-9; and controlled automation, TH-9. They each include manufacturing, operating, selection and engineering assistance data. Data sheet PM-116 on magnetic principles discusses magnetic suspension, torque control, driving and braking with permanent magnets.

SAVE HOURS, CUT COSTS

ON YOUR PIPING JOBS WITH

GREENLEE PIPE PUSHER

Here's the quick, simple way to install underground pipe. With a GREENLEE Hydraulic Pipe Pusher *one man* pushes pipe *under* streets, walks, tracks, lawns, floors and other obstacles. Cuts job time to a fraction . . . no costly tearing up of paving . . . eliminates extensive ditching, as just a short trench accommodates the Pusher. No tedious tunneling, back-filling, tamping or re-paving. Greatly reduce job time, reduce costs with the GREENLEE which often pays for itself on the first few jobs. Compact, portable, powerful. Get facts today.

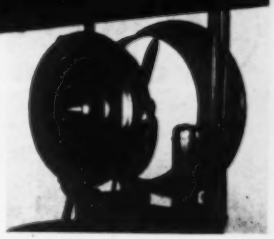
Two sizes to fit the exact needs of yours jobs: No. 790, at left, for ¾ to 4-inch pipe. 6,500 to 40,000 lbs. pushing power. No. 795, lower left, for pipe larger than 4-inch, concrete sewer pipe, large drainage ducts. 25,000 to 150,000 lbs. pushing power. Power pump at right for extra ease and speed of operation.

TOOLS FOR CRAFTSMEN

GREENLEE

Greenlee timesaving tools for plumbing and heating work . . . Hydraulic Pipe Benders • Tubing Benders • Hydraulic Pipe Pushers • Pipe Bits • Auger Bits • Spiral Screwdrivers • Chisels and Many More. Write for details. Greenlee Tool Co., 2351 Twelfth Street, Rockford, Illinois.

Bahnson CENTRIFUGAL HUMIDIFIERS



BAHNSON TYPE H&L

America's most widely used Industrial Humidifying Units!

Controlled humidification at lowest cost! Time proved in hundreds of industries, Bahnson's centrifugal atomization of ordinary city or well water provides highest capacity per dollar.

ONLY BAHNSON OFFERS ALL THIS!

- **TOPS IN ECONOMY**—Centrifugal Humidifiers give double economy—lower first cost, lower operating cost.
- **SINGLE or MULTIPLE** installation—with individual or group control completely automatic.
- **HIGH CAPACITY**—Up to 8 gph with Type H; up to 12 gph with Type L.
- **SELF-CONTAINED**—Needs no pumps, ducts, compressors, steam lines or floor space!
- **SIMPLE TO INSTALL**—Just suspend from ceiling, column or wall and connect water, drain, electricity.
- **DIRECTIONAL AIR FLOW**—Assures proper distribution of moisture and uniform conditions.
- **TROUBLE-FREE**—No nozzles to clog—simple to operate and maintain, guaranteed by Bahnson, builder of the world's most complete line of industrial humidification equipment.

There is a Bahnson system for every application. If Centrifugal Humidifiers don't meet your exact needs, we have other equipment tailored to your exact needs.

Send data on your commercial or industrial humidification problems—we'll return complete recommendations without obligation.

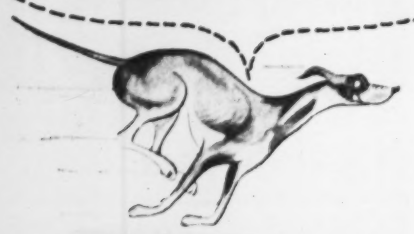
Clip coupon to your letterhead and mail today.

☐ Send information on Centrifugal Humidifiers
☐ On other industrial humidification equipment
☐ Have engineer call

Name_____

Bahnson Company
ENGINEERS AND MANUFACTURERS
WINSTON-SALEM, N. C.

Here's why AGITAIR FM AIR FILTERS are so doggone popular!



High velocity...highest efficiency.

⅓ less space required.

Lower installation and maintenance costs.

Long serviceable life.

Designed for an approach velocity of 530 fpm over the net media area, the high filtering efficiency of the AGITAIR FM increases as the dust load is applied. You save ⅓ in space required, in number of units to be installed and serviced. Very large dust-holding capacity of AGITAIR FM assures longer service periods, fewer cleanings per year, lower service charges. No exposed wire ends to cut or damage hands of service operators. Compare. Send today for free Cost Comparison Chart.

AIR DEVICES INC.
185 Madison Avenue, New York 16, N. Y.

FILTERS • AIR DIFFUSERS • EXHAUSTERS

RECENT TRADE LITERATURE . . .

Manufacturer—General Electric Co., Carboloy Dept., 11177 E. Eight Mile Rd., Detroit 32.

Expansion Joint Guide

A new 24-page *Flexon Expansion Joint Design Guide* has recently been released. Catalog 135 contains engineering application and selection data for pipeline expansion problems. Covered are expansion joint design considerations, installation instructions and selection data. The center spread of the catalog is devoted to a schematic piping layout illustrating various expansion joint applications and principles.

Manufacturer—Flexonics Corp., 1314 S. Third Ave., Maywood, Ill.

Filters for Air Conditioning

Bulletin No. 600 describes and illustrates "Staynew" ventilation and air conditioning filters. The bulletin contains specifications, engineering and performance data covering dry type panel filters recommended for the removal of air-borne impurities.

Manufacturer—Dollinger Corp., 11 Centre Park, Rochester 3, N.Y.

Flow Meter

Eight-page booklet on the "Diaflow" meter gives data for measuring air flow, gas flow, and the ratio of air flow to gas flow. The meter described in Publication 52-1017-37 employs the pilot method of operation; dry diaphragm-type measuring element; package unit construction.

Manufacturer—The Hays Corp., 800 E. Eighth St., Michigan City, Ind.

Hair Hygrometers

Bulletin 6504 describes industrial hair hygrometers and thermometers, recorders and recording controllers. The hygrometers are used to measure relative humidity in the moderate temperature range. They employ a human hair hygroscopic element. The bulletin lists special construction features, applications and specifications.

Manufacturer—Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Station 64, Philadelphia 44.

Industrial Water Softener

Brochure presents information on the specifications of water softener equipment. The booklet contains complete data on valves, as well as chart-type specifications on "Illico-Way" softener units showing exchange capacities, flow rates, size of units and meters, volume of mineral, amount of salt and shipping weights. A cutaway drawing shows the operation of the unit.

Manufacturer—Illinois Water Treatment Co., 840 Cedar St., Rockford, Ill.

Liquid Seals for Refrigerants

Bulletin No. 241 tells how to keep high pressure refrigerant gas out of the evaporator when the liquid level in the receiver drops below the outlet pipe.

RECENT TRADE LITERATURE . . .

It covers the operation, selection and installation of the company's cast semi-steel and forged steel liquid seals and expansion valves. Selection charts are included for ammonia, "Freon" and "Carrene" refrigerants.

Manufacturer—Armstrong Machine Works, 874 Maple St., Three Rivers, Mich.

Mathematics Manual

Newly revised *Manual of Mathematics* is a pocket-size data book intended for those in the civil, mechanical and electrical engineering fields. Included are tab-indexed sections on mathematical reviews, logarithmic tables, natural trigonometric functions, conversion tables, functions of numbers, etc. The section on mathematical reviews contains more than 200 equations on algebra, analytical geometry, trigonometry, differential and integral calculus.

The 334-page book is available from Lefax Publishers, Philadelphia 7, at $2.25 a copy.

Mechanical Seals for Pumps

A 20-minute, color film on mechanical shaft seals for centrifugal pumps now is available. Designed for showings to engineering and maintenance meetings, this film covers mechanical seals from design to maintenance. Various seal types and their applications are described. Seal operation is graphically illustrated by animated drawings.

Also available is a condensed transcript of the film in Bulletin No. 153-10,000, complete with photographs.

Manufacturer—Byron Jackson Co., P.O. Box 2017, Terminal Annex, Los Angeles 54.

Multi-Stage Centrifugal Pump

Bulletin No. 237-C describes "Thrust-fre" two, three and four-stage pumps for heads up to 650 psi and with capacities of from 50 to 850 gpm. Available in both sleeve bearing and ball bearing designs for boiler feeding and general power plant and industrial use, the pumps are designed to achieve a hydraulic balance by a patented method. Each type of pump is illustrated with detailed diagrammatic drawings. Complete specifications are included.

Manufacturer—Pennsylvania Pump and Compressor Co., Easton, Pa.

Pop Safety and Relief Valves

Circular 502 illustrates the company's line of pop safety and relief valves for steam, air, gas, water, oil and other liquids. Complete with dimensions, the circular gives information in the form of steam, air and gas relieving capacity tables. Also featured is a table of multipliers for computing relieving capacities at various inlet temperatures. Another table of multipliers permits computing relieving capacities for air valves for use in handling gases and vapors.

Manufacturer—The Lunkenheimer Co., Box 360, Cincinnati 14.

Portable Motor Welder

Illustrated four-page bulletin describes the "Portable Motor Weld", a portable motor welder

No need to Improvise or compromise when you specify

AGITAIR

Only AGITAIR square and rectangular air diffusers are custom-made to suit conditions of each application. The patented, built-in diffusing vanes are scientifically arranged in various louve patterns which provide blows in 1, 2, 3 or 4 directions without use of blank-offs. This feature eliminates the necessity of "oversizing" to compensate for blank-offs or baffles.

When you specify AGITAIR square and rectangular diffusers you can be sure of 100% draftless air distribution from any ceiling or sidewall location. What's more, these smart, modern units are now available with or without removable, interchangeable cores. Whatever the space condition, there's an AGITAIR custom-made to give perfect performance and complete satisfaction.

New 34-page Type R Catalog reveals how correct air distribution is simplified by AGITAIR. Contact your local AGITAIR representative, or write us direct for your free copy.

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AIR DIFFUSERS • FILTERS • EXHAUSTERS

Keep TABS on WIRING PERFORMANCE with-

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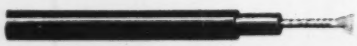
Chester ENGINEERED plastic insulation, laboratory and field tested to more than meet specifications, provides both easier working qualities and longer service life. These rugged plastic coatings offer maximum immunity to abrasion, weather, oil and most chemicals. Smooth and pliable, they pull through conduit easily.



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"Chesty" HAS THE ANSWERS — Plasticord and Plasticote wires are available in standard constructions or custom built to specifications. For a practical solution to unusual insulated wiring problems, call or write.

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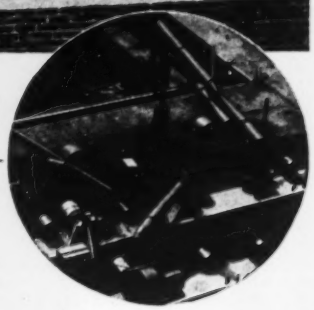

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For a Supersonic WIND TUNNEL

● New and improved, this NIAGARA METHOD that effectively dries outdoor air for a wind tunnel used for testing at supersonic speed, can be trusted to give you the best air conditions for your purpose:

- **to dry your materials or products**
- **to prevent condensation or moisture damage**
- **to protect your moisture-sensitive processes**
- **to give you an atmosphere in which your product can be packaged or stored safely**
- **to give you exactly the right atmospheric conditions for testing materials**
- **to put "fresh air" back into your air conditioning, increasing its capacity and effectiveness**

The Niagara "fresh air" Method removes the excess moisture from outdoor air by contact with an absorbent liquid in a spray chamber. The liquid contact temperature and the absorbent concentration, both controlled thermostatically, determine the amount of moisture in the conditioned air. Heating or cooling the air is a separate function. Therefore, you can easily and inexpensively have a precisely controlled condition without the use of moisture sensitive instruments.

The Niagara Absorbent Spray Method is noted for solving the really difficult problems of air conditioning. Write for complete information.

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Over 35 Years of Service in Industrial Air Engineering

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Field Engineers in Principal Cities of U. S. and Canada

RECENT TRADE LITERATURE . . .

equipped with a self-contained motor generator. According to the manufacturer, this machine welds, brazes, grinds, sands, polishes, buffs, brushes, supplies power from power unit and charges batteries. Various applications are illustrated and each of the four models is fully described.

Manufacturer—Generator Sales Co., 1627 N. Damen Ave., Chicago 47.

Portable Potentiometer

Bulletin 1210 covers the "Brown" portable potentiometers, with direct reading temperature, millivolt and extended range scales. Wiring diagrams, instructions, specifications and special features are also included.

Manufacturer—Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Station 64, Philadelphia 44.

Power and Fluids

This corporation has recently announced the publication of the first issue of a new technical magazine, *Power and Fluids*. To be published quarterly, it will discuss new power product applications, processes and methods in the power and fluid handling fields. Subjects covered will include installations, operation and maintenance of industrial apparatus.

Published by—Worthington Corp., Harrison and Worthington Sts., Harrison, N.J.

Pressure Plugs

Heat treated pressure plugs which are designed to seal tight without sealing compound by crushing crests and roots in softer threads of mating tapped parts, are described in this new bulletin. In pictures, drawings and text, the bulletin describes the sealing operation of the "Unbrako Dryseal-Thread" pressure plug. Dimensions are listed.

Manufacturer—Standard Pressed Steel Co., Box No. 810, Jenkintown, Pa.

Pressure Relief Valve Sizing

A new 24-page booklet, *Selection and Sizing Pressure Relief Valves to Comply With ASME Boiler Code Requirements*, has recently been published. It is intended as a guide for calculating or determining gross heat outputs of boilers, tanks and heaters. Formulas and tables cover recommended relief valves for cast iron boilers and steel boilers, as well as those boilers for which there is no nameplate data or set procedures for establishing the output. Also covered are hot water supply heaters and tanks, heat exchangers and unfired pressure vessels.

Published by—McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago 18.

Recording Instrument Accessories

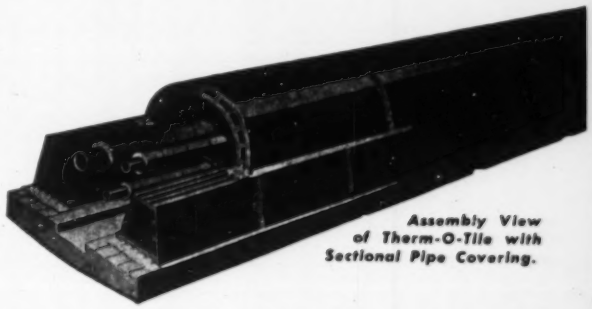
Data book and catalog, TC 10, has been prepared to aid in solving process control problems. Described are thermocouples, radiation detectors and

Therm-O-Tile

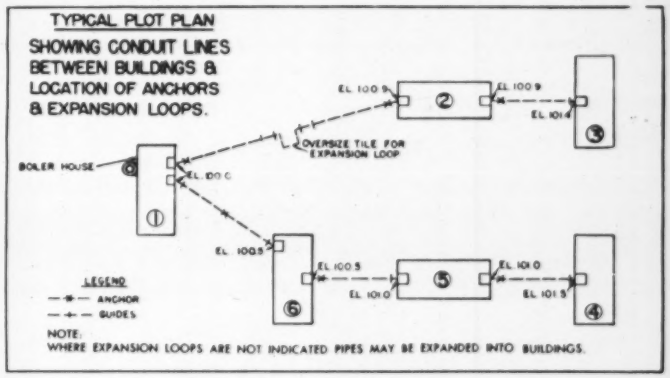
REG. U.S. PAT. OFF.

Underground Steam Conduit

— for the permanent support, protection, and insulation of underground pipe lines.



Assembly View of Therm-O-Tile with Sectional Pipe Covering.



Typical Plot Plan taken from Bulletin 511.

FOUNDATION — a thick concrete slab poured directly on the trench bottom, reinforced with steel when necessary.

DRAINAGE — entirely internal, open to inspection at manholes and ample in capacity to keep pipe space permanently dry.

PIPE SUPPORT — by means of cast iron adjustable supports resting directly on the concrete base.

ACCESSIBILITY — all piping installed before tile is placed affording complete accessibility on the concrete slab "sidewalk."

STRENGTH — arched construction sustains any roadway traffic load. Stronger than A.S.T.M. requirements.

INSULATION — either sectional pipe covering or filler.

EFFICIENCY — surrounded by sealed air and dry insulation — assures high thermal efficiency.

JOHNS-MANVILLE. Sold and installed by Johns-Manville Construction Units in all principal cities.

BULLETIN. Ask for Bulletin 511 which gives complete information.

H. W. PORTER & CO., INC.

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Insulation Engineers & Contractors

EXCLUSIVE
All other manufacturers expand the tube to bond the fins. This practice tends to weaken the tube and often results in tube fracture at the weld. Brown Heavy-Duty Bayce-Heet is made by a new improved process. The fins are headed onto the tube. No expansion of the tube is necessary. Thus the tube is strengthened and will not fracture.
This exclusive Brown process does more! It provides a perfect bond for most efficient heat transfer. It makes it possible to cut and rethread the tube at any point . . . a welcome advantage when an odd length is needed on the job. No other fintube gives you this advantage.
EASIER TO INSTALL
GREATER EFFICIENCY
32 FINS PER FOOT
10-15% LOWER COST
SAFETY FIRST! Heavier gauge fins with rounded corners guard against cut fingers when installing.
BROWN PRODUCTS COMPANY
FOREST HILLS, NEW YORK
BROWN
BAYCE-HEET
THE NEW LEADER
IN
INDUSTRIAL FINTUBE
ILLUSTRATED LITERATURE ON REQUEST

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resistance bulbs. Also included is information on protection tubes, lead wire and other accessories for use with indicating, controlling and recording instruments.

Manufacturer—Wheelco Instruments Div., Barber-Colman Co., 1228 Rock St., Rockford, Ill.

Refrigeration, Air Conditioning Controls

Condensed catalog on refrigeration and air conditioning controls contains complete information on applications, engineering data, dimensions and specifications and ordering procedure. New products described include an extended group of single pole and two pole, heavy duty refrigeration controls, a new cooling tower control and a duct fire protection control.

Manufacturer—Penn Controls, Inc., P. O. Box 556, Goshen, Ind.

Steam Generators

Bulletin G.B.-153 covers the manufacturer's line of steam generators and allied equipment. Described are eight basic arrangements of two, three and four drum steam generators for a wide range of loads, pressures and temperatures for power, process and space heating; heat recovery units, including fire tube and water tube boilers, plain tube and waste heat extended surface economizers; process equipment including "Dowtherm" vaporizers, reaction kettles, autoclaves, heat exchangers and liquid heaters. Design drawings and photographs are accompanied by brief summaries.

Manufacturer—Union Iron Works, 1500 Cascade St., Erie, Pa.

Steam Traps

Bulletin No. 853 features steam traps equipped with bellows of bronze, monel or stainless and bodies in bronze, semisteel and cast steel construction in sizes ¼ in. to 2 in. for pressures from vacuum to 300 lb. Included, besides capacity tables and dimensions, are recommended piping diagrams, typical applications, tables and data covering the selection of traps for various types of steam using equipment.

Manufacturer—W. H. Nicholson & Co., 12 Oregon St., Wilkes-Barre, Pa.

Synthetic Rubber

Typical properties, uses and compounding of synthetic rubbers are described in a new four-page bulletin. According to the manufacturer, the information is designed to aid manufacturers in the selection of special purpose elastomers to withstand oils and solvents, the effect of aging and extreme low temperatures. Applications in the electronic, coating, petroleum and gas transmission industries are described.

Manufacturer—Thiokol Chemical Corp., 780 N. Clinton Ave., Trenton 7, N.J.

Temperature Ratings of Pipe

Techanical Bulletin TBI-1953 contains more than 5000 pressure-temperature ratings of the various grades of pipe in common use in power plants. Titled, *Pressure-Temperature Ratings of Plain End Pipe Used in Power Plant Piping Systems*, the ratings in the booklet

The beauty of Duriron is much more than SKIN DEEP

Resists corrosion from here to here

Write for Bulletin PF/4 for complete details

The beauty of Duriron, of course, is that it offers extremely high resistance to corrosion at reasonable cost. It is not appreciably affected by constant high temperature. This resistance is not just on the surface but *throughout the pipe wall.* That's why you can install this high silicon iron alloy piping and forget it, in most cases. Available from stock in principal cities.

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404 North Findlay St.
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INDUSTRIAL
DRAFT CONTROLS
FOR EVERY NEED — ANY SIZE — ANY SHAPE

Outperform and outlast
ORDINARY CONTROLS

COLE
Standard Round Damper Control

Saves 10% to 30% on fuel. Internal damper type. Ball bearing equipped counterbalanced in all positions. Large close fitting blades. Top or side mounting. Stock sizes 8" to 30". Special sizes on order.

COLE
Standard Square Gate Control

Open check type. Perfectly counterbalanced. Ball bearing equipped. Stock sizes from 14" to 36". Can be mounted on either side or top of breeching. Special sizes on order.

Exclusive Territories Available for Sales Engineers

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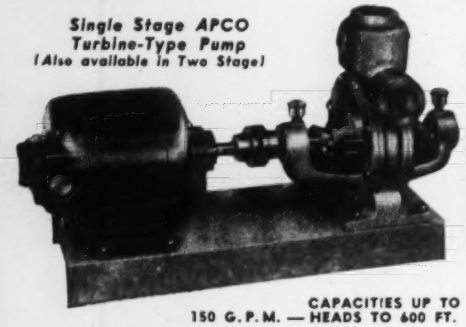
YOU CAN'T BEAT APCO TURBINE-TYPE PUMPS FOR BOILER FEED

Single Stage APCO Turbine-Type Pump (Also available in Two Stage)



CAPACITIES UP TO 150 G.P.M. — HEADS TO 600 FT.

Specify Apcos because they have "What it Takes"

Apco Pumps will do a better job for your customer friends

You may, with complete confidence, sell — specify — or install APCO on boiler feed duties. APCO pumps are distinguished for their ability to deliver small capacities against high heads with but slight change in capacity or efficiency against drastic head variations. Insure satisfaction with the following array of modern features, found completely ONLY in APCO:

SIMPLE—WEAR-FREE COMPACT
•
HIGH EFFICIENCY
•
WILL NOT VAPOR BIND
•
HYDRAULICALLY BALANCED
•
ACCESSIBILITY
•
HIGH SUCTION LIFT (28 ft. at sea level)
•
QUIET OPERATION

HIGH PRESSURE PER STAGE
•
DOUBLE SUCTION DESIGN
•
PRECISION SHAFTS
•
BALL BEARINGS (Support on both sides of Impeller)
•
RIGHT OR LEFT HAND OPERATION
•
REPLACEABLE COVER PLATES

PUMPS "by Aurora" FOR MANY PURPOSES

Among Apco Turbine-Type Pumps and Aurora Centrifugal Pumps are quality units for many purposes. We invite you to acquaint yourself with the wide variety of Pumps "by Aurora." We invite your inquiries and pledge our friendly cooperation.

Write us for Condensed Catalog or Individual Bulletins

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA Always PUMPS

AURORA PUMP COMPANY

Subsidiary of the New York Air Brake Co.
80 Loucks St. AURORA, ILLINOIS

RECENT TRADE LITERATURE . . .

have been calculated by the recently revised formula and allowable stress values applying to the ASA Code for Pressure Piping and the ASME Power Boiler Code. The ratings are arranged for easy reference.

Published by—The Pipe Fabrication Institute, 813 Clark Bldg., Pittsburgh 22.

Tube and Pipe Fittings

General catalog No. 553 covers the company's high-pressure tube and pipe fittings. Described and illustrated with cutaway drawings and photographs of the "Prize Pair" flare and no-flare type tube fittings which are designed to seal pressures that will burst the tube. These fittings feature an alloy-steel sleeve with collet spring cantilever fingers which withstands hydraulic impact shocks and absorbs excessive tube vibrations. Engineering tables are supplemented with specifications on all fittings. Proper selection aids are also given.

Manufacturer—Flodar Corp., 1342 E. 45th St., Cleveland 3.

Tubing and Pipe for High Temperatures

Folder TDC 163 presents condensed technical data on 14 tubing steels used in high temperature or high pressure service. Data on analyses, mechanical and physical properties, creep strength, short-time elevated temperature tensile properties, oxidation resistance and other pertinent information, is presented on a complete series of tubing steels ranging from plain low-carbon steel to 25 percent chromium-25 percent nickel stainless steel.

Manufacturer—Tubular Products Div., Babcock & Wilcox Co., Beaver Falls, Pa.

Tubular Steel Scaffolding

Six-page color folder, No. 53, illustrates various panel styles of scaffolds and identifies proper application. It contains a description of the method of panel and brace assembly with self-contained cam and stack locks designed to speed up assembly and dismantling through elimination of bolts, nuts, clamps and other methods of attachment.

Manufacturer—Advance Scaffold Div., Beaver Art Metal Corp., Dept. E-1, Ellwood City, Pa.

Waste Pumps

New 12-page bulletin presents a description of municipal and industrial waste pumps. The booklet covers features, performance information, specifications and selection data for plunger sludge pumps, mud-hog diaphragm pumps, and self-priming centrifugal pumps used on sludges and slurries.

Manufacturer—Marlow Pumps, Ridgewood, N.J.

Water Tube Boiler

Four-page folder gives details on the company's line of shop assembled, water tube boilers. The bulletin includes a description of the "Type H" boiler, along with illustrations of the unit in process of shop assembly. Also shown are dimension drawings and a table of capacities, dimensions and weights for 10 standard sizes ranging from 8000 to 30,000 lb steam per hr.

Manufacturer—The Bigelow Co., 174 River St., New Haven 3, Conn.

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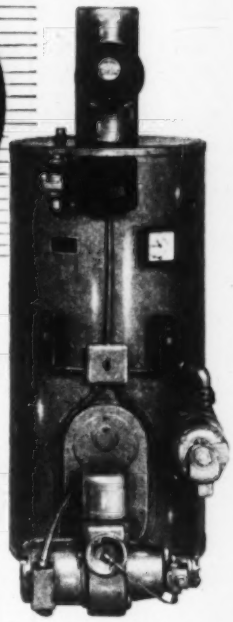
..when Selling gets **HARDER!**



ALDRICH *Gulf Stream* PACKAGE BOILER-BURNERS

Home building is leveling off – and competition for heating plant installations is keener. Now you will have a better chance of getting your share if you feature the new Aldrich GULF STREAM Boiler-Burner. Here's why:

The GULF STREAM was developed for small home owners to furnish economical hot water heat and instant domestic hot water supply with either oil or gas. Five sizes cover every need and budget. SBI net ratings from 440 to 1120 sq. ft. of water radiation. All meet ASME code.

COMPACT and RUGGEDLY BUILT GULF STREAM is easy to install, efficient and dependable. The Aldrich GULF STREAM will close more sales when people demand MORE for every heating dollar invested. Write for money-making details.

GULF STREAM STANDARD

Shipped fully erected with complete automatic controls; stack switch, thermostat and limit control.

HOT WATER HEATER

Internally galvanized in five sizes with 100-255 GPH at 100° rise. Instant, directly heated, hot water supply.

ALDRICH GULF STREAM Offers VALUE!

SBI ratings, 440-1120 sq. ft. water radiation

Flue tubes baffled for maximum heat extraction

Aldrich burners operate Gulf Stream boilers

For inspection and maintenance, removable top jacket, large opening to combustion chamber.

Min. temperature change regardless of firing conditions.

Designed for standardized production; to meet ASME code. Burners U.L. listed

A subsidiary of Breeze Corporation, Inc.

ANOTHER BREEZE MARK PRODUCT

ALDRICH

105 East Williams St.
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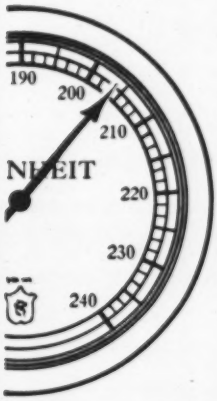
SBI ALDRICH HEAT-PAK PRODUCTS



if high fuel oil temperatures are what you need—the Paracoil TYPE "GF"

INDIRECT GAS FIRED FUEL OIL HEATER is the answer!

With sub-water-line oil heaters, a low circulating boiler water temperature can play havoc with even the best engineered No. 6 oil burner layouts—particularly with the viscous oils now being used!

Our Type "GF" Indirect Gas Fired Heater can give you any desired oil temperature you want—without the use of expensive electric boosters!

APPLICABLE TO ALL TYPES OF OIL FIRED APPARATUS!

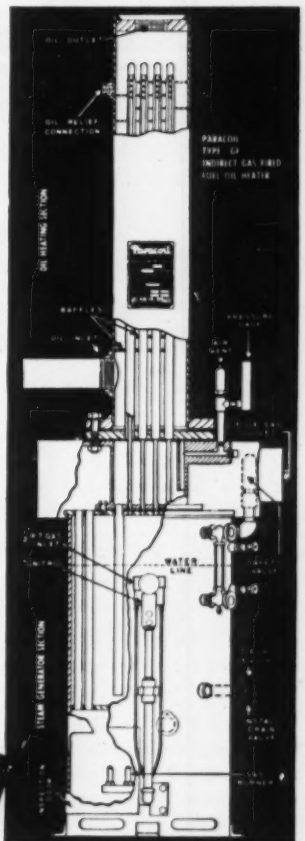
As it is not dependent upon the unit it is servicing for the means of heating the oil, the Type "GF" Heater can be applied to any oil fired apparatus, be it a steam or hot water boiler, a process oven, a dryer or a kiln!

ONE HEATER CAN SERVE MANY BURNERS!

No steam piping required. Heater operates on a closed, internal steam and condensate cycle!

CHECK THESE FEATURES!

Completely factory assembled • Easy to install anywhere, even outdoors • Requires only minimum of floor space • Economical to operate • Wide range of oil heating capacities • Burns any specified type of gas fuel • High oil temperatures at all times • Operation unaffected by normal variation in viscosities of oils being heated.



*Patents Pending

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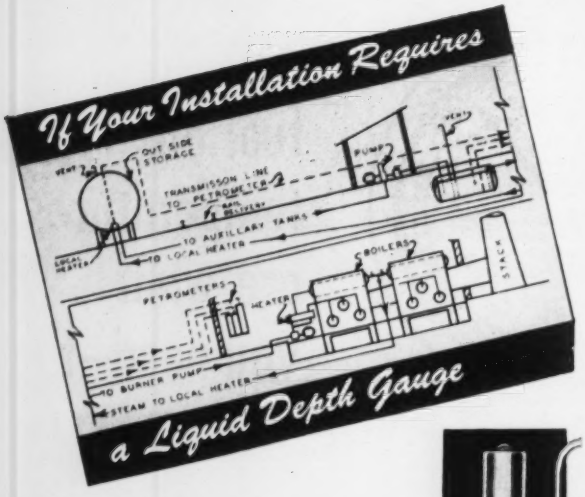
Approved by Board of Standards and Appeals City of New York

DAVIS ENGINEERING CORPORATION

1064 EAST GRAND ST., ELIZABETH 4, N. J. • 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.



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REMOTE READING

TANK GAUGES

THE BEST GAUGE FOR:

Commercial and Industrial Fuel Oil Tanks

Domestic Installations with Buried Tanks

Storage Tanks for other liquids—gasoline, solvents, acids, etc.

Here's Why:

No troublesome moving parts—operates on the sound principle of the U-tube. Simple, dependable and accurate.

Large, easy-to-read vertical scale gives tank contents at a glance. Eliminates the cumbersome measuring stick and the inconvenience of climbing the tank.

Installation is easy—gauges can be installed on tanks above or below ground level and up to ¼ of a mile away. The tank assembly for the gauge can be installed even when the tank contains liquid. It can also be fitted in the tank separately to complete the tank work. The gauge can be connected any time later. Just tighten one simple connection and the job is finished.

FOR TANKS 20 INCHES TO 50 FEET DEEP. ***Write for Bulletin PH.***

LIQUIDEPTH INDICATORS, INC.

43-22 TENTH ST., LONG ISLAND CITY 1, N. Y.

WE HEAR THAT . . .

MARLOW PUMPS, Ridgewood, N. J., merges December 1 with the *BELL & GOSSETT CO.* Both product lines retain their individual identity throughout sales, marketing and distribution. Under the new set-up, Marlow Pumps will be known as the Marlow Div. of Bell & Gossett and will be headed by A. S. Marlow, Jr., as general manager. He will also be a vice president and a member of the board of directors of Bell & Gossett.

Builders Iron Foundry recently changed its name to *B-I-F INDUSTRIES, INC.* Since the output of the foundry represents less than 10 percent of the company's total business, the name change was voted to better identify the various products of the corporation. B-I-F Industries, Inc. is the parent company of Builders-Providence, Inc., Proportioneers, Inc., Omega Machine Co. and Builders Iron Foundry.

AEROVENT FAN CO., INC. has announced the opening of its new general office building at 700 E. Ash St., Piqua, Ohio. One of the features of the completely modern building is a five-zone air conditioning and heating system which permits automatic temperature control in winter and summer in accordance with the individual desires of employees working in various areas.

A change in company name from Vanton Pump Corp. to *VANTON PUMP & EQUIPMENT CORP.* has been announced. According to *PRESIDENT J. J. ASHTON*, the new name was decided upon in view of the company's addition of corrosion resistant plastic and hard rubber valves, pipe and fittings to its regular line.

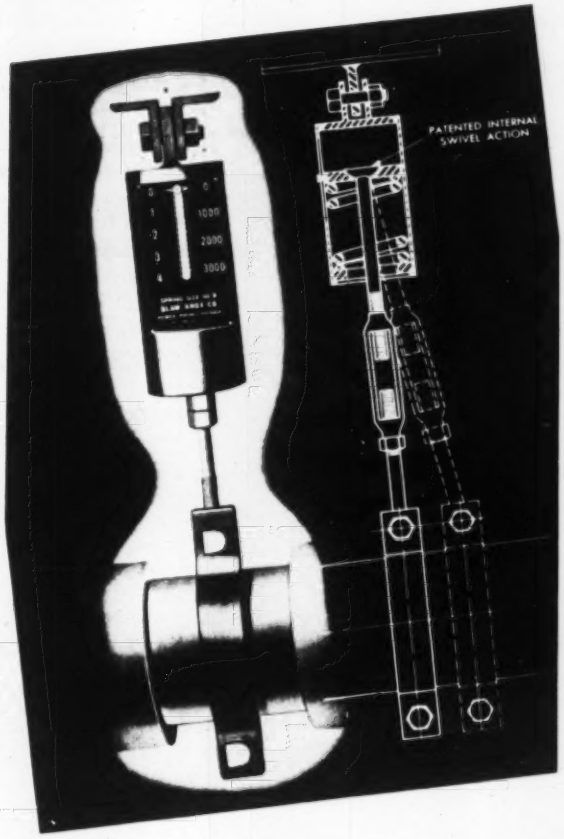
It has also been announced that the Vanton manufacturing plant has been moved from Long Island City, N. Y. to a new building on the premises of its affiliate company, the Cooper Alloy Foundry Co., Hillside, N. J. Executive and sales offices will remain at the Empire State Building, New York 1.

The *LUNKENHEIMER CO.* is expanding its facilities for producing steel and iron valves at its Carthage, Ohio plant. Steel and iron castings will be supplied to the company's specifications by outside sources.

With the dissolution of Rowan and Buchanan, former representatives of the *UNITED STATES GASKET CO.* in the Houston area, the representative is the newly formed *WM. C. BUCHANAN CO.* of 4101 San Jacinto St., Houston 4.

A new 10,000 sq ft addition to the *MONROE TUBE CO., INC.*, recently was completed. The new plant wing is now completely equipped and includes a continuous annealing furnace and tube pointing equipment.

The heating department headquarters of the Machinery Div. of *DRAVO CORP.* has been moved to provide great-



"Ready-Made" for Any Piping Layout

To save engineering time and eliminate expensive cutting, threading and assembling in the field, just specify—

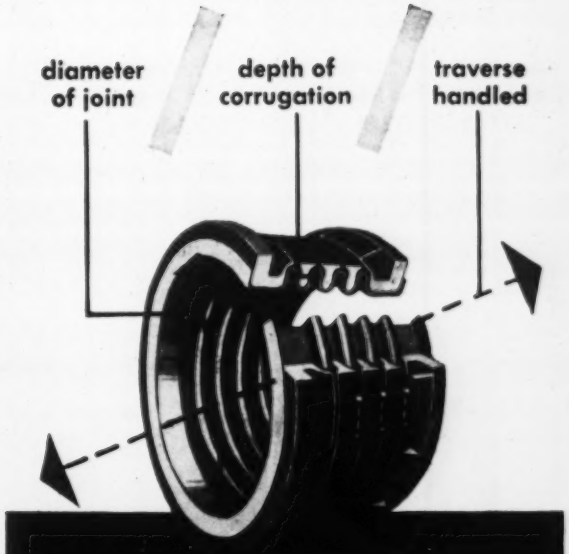
BLAW-KNOX HANGERS

Whether the installation calls for Rigid Hanger Assemblies, Functional Hangers, Vibration Eliminators or Overhead Roller Assemblies, you'll find each furnished as a complete unit designed to do the best job. Blaw-Knox pioneered in this field and has brought to it many improvements in hanger design—including the patent Internal Swivel Action which permits both lateral and longitudinal movement, while the hanger case itself remains vertical. Engineers who have solved some of the toughest hanger problems are available at all times to apply their experience to any installation that presents difficulties.

For complete technical data and time-saving information on hanger locating, send for Catalog No. 51.

BLAW-KNOX COMPANY
POWER PIPING AND
SPRINKLER DIVISION
PITTSBURGH 33, PA.

BLAW-KNOX



HOW THIS RELATIONSHIP **SAVES** IN EXPANSION JOINT COSTS

For each range of BADGER Expansion Joint Diameters, there is a carefully calculated depth of corrugation and a definite limit of traverse to be absorbed by this corrugation. The traverse is gauged to the depth of corrugation.

With four different corrugation depths, there is no need either to over-stress tube metal when forming the corrugation or to "over-traverse" the expansion joint installation in order to be sure of having ample capacity. The former assures longer joint life; the latter saves you in initial cost. You don't have to risk "under-traversing" the job. The joint, being just right for the job, means maximum life.

The more you study the Badger Expansion Joint—both the Self-Equalizing Directed Flexing and the Non-Equalizing Types—the more you will see and appreciate the careful engineering that has gone into these joints. And the more you study the work an expansion joint is to do, the more you will appreciate why sound engineering is a 'must' in expansion joints. You get it in Badger Joints.

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET • CAMBRIDGE • MASS.

No longer is it necessary to invest in dual fuel to utilize gas.

just Add gas!

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The Packaged Rectilinear makes four inches pressure do the work of four pounds with fractional horsepower.

You can fire gas — automatically — through any narrow opening without disturbing your present firing equipment — hand or stoker fired coal, oil or whatever it may be.

*TRADEMARK

Write for Literature

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio

WE HEAR THAT . . .

er area for increased production. The new quarters are located in the Chamber of Commerce Bldg., 411 Seventh Ave., Pittsburgh 19.

The *De LAVAL STEAM TURBINE CO.* has been given the Award of Merit for public relations communications by the New Jersey Manufacturers Association. The presentation was made in conjunction with the "Voice of New Jersey" series of radio programs. De Laval was cited for its achievements in the development, growth and prosperity of New Jersey.

ECLIPSE FUEL ENGINEERING CO. recently acquired the Solenoid Valve Div. of the Wheaton Engineering Co. The purchase includes complete production equipment, patents, engineering drawings, etc. Production of solenoid valves, to be listed as Eclipse Series "DO", was scheduled to begin last month.

The *A. F. DAVIS WELDING LIBRARY* located at Ohio State University, Columbus, recently acquired more than 2200 abstracts of British welding patents. The library was established in 1942 by A. F. Davis, vice president and secretary of the Lincoln Electric Co., Cleveland, to assemble in one place all the important literature on welding. More than 15,000 patents have now been classified in the library's collection.

The *OLIPHANT COMMERCIAL CORP.*, manufacturers' representative for heating and ventilating equipment, has opened new warehouse facilities at 610 Oak St., Oakland, Calif. It will service industrial supply jobbers in northern California.

The *REFINITE SALES CO.* and the *ELGIN SOFTENER CORP.* have joined forces to offer a more complete line of water conditioning equipment and water treating chemicals. The two firms are joining their research, technical and sales organizations to provide a broader engineering service. The products and services of both companies now are being handled by a combined sales-engineering organization known as *ELGIN-REFINITE, INC.*, a newly created division of Elgin Softener Corp. with headquarters at Elgin, Ill. In the case of overlapping products, the new developments and patented features of both Elgin and Refinite are being pooled for the advantage of the consumer.

In a recent speech before a meeting of the National Association of Aluminum Distributors, *KEEN JOHNSON* predicted that an ample supply of aluminum is not far away. Mr. Johnson, vice president and director of public relations for the Reynolds Metals Co., said that production of primary aluminum in the United States increased 475 percent between 1939 and 1952, and that more than 4000 new peacetime uses for aluminum have been developed. Aluminum production in 1952, on a volume basis, was

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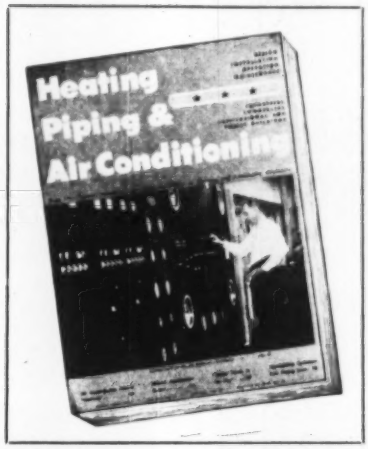

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BOOKS

of reprinted material that originally ran in HEATING, PIPING & AIR CONDITIONING

• CORRECT PRACTICE IN AIR CONDITIONING BUILDINGS

Problem-dissolving information here shows how 55 eminent air conditioning engineers and contractors worked out scores of difficult problems. Basic principles and how-to-do-it facts—vital data on design, installation, operation—recommended techniques and systems in actual use . . . for office buildings, hotels, stores, hospitals, insurance firms, colleges, banks, etc. Enough data for TWO 200-page books were compressed into one compact book—full size, 8½" by 11". 240 pages, only $1.50.

• CORRECT PRACTICE IN INDUSTRIAL PIPING

(All-new second edition.) A collection of outstanding piping data selected from five years' issues of "Heating, Piping and Air Conditioning." Very comprehensive and practical. Reveals how various difficult piping problems that arose in different industrial plants were successfully worked out by 33 piping engineers. Design, installation, operation, and maintenance . . . steam, air, gas, oil, process, water and refrigeration piping . . . piping in food, chemical and textile industries—in refineries, paint, plastic, paper and steel mills—in railroads, utilities, etc. 196 pages, $1.50.

• CORRECT PRACTICE IN HEATING INDUSTRIAL PLANTS

Practical solutions to specific problems in all kinds of plants, factories, and mills—for changing, expanding, modernizing—planning maintenance—saving fuel—servicing boilers, oil burners—correcting corrosion—figuring heating requirements, also cost of steam—uniform heat control—converting to mechanical firing—snow melting systems, etc. Applications for heating, ventilating, processing, drying—packaged steam generators—heat pumps—unit heaters—radiant panel heating—low-pressure steam—central heating. Articles by 28 heating engineers reprinted from Heating, Piping and Air Conditioning. Full size, 8½" by 11". 132 pages, $1.50.

• CORRECT PRACTICE IN HEATING LARGE BUILDINGS

An all-new second edition presenting practical heating data reprinted from *Heating, Piping and Air Conditioning*. An inspiring record of 37 foremost heating specialists' experiences. Actual installations that proved most efficient for hotels, stores, office buildings, hospitals, banks, churches, schools and colleges. Methods for enlarging or modernizing old systems—maintenance—fuel saving—sizing piping—temperature and boiler control—stopping building heat leaks, etc. Full, 8½" by 11" size. A lot for your money. 132 pages, $1.50.

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WE HEAR THAT . . .

greater than the combined production of copper, zinc and lead. Mr. Johnson pointed out.

BITUMINOUS COAL RESEARCH INSTITUTE, INC. recently completed the first industry-owned laboratory at Columbus, Ohio, to expedite its program of helping customers get maximum value from coal. Typical projects are research and development of automatic steam generators and gas producers for industry, automatic coal-burning equipment for heating and combustion without air pollution. The laboratory staff is headed by *ELMER R. KAISER*, associate director of research.

CARRIER CORP. soon will have three major operating divisions, each of which will engineer, manufacture and market its own product lines. One of the new groups will be the Unitary Equipment Div. This will handle product lines such as reciprocating compressors, room air conditioners, year-around residential units and other self-contained air conditioning devices. It will be headed by *JOHN H. HOLTON*, vice president and general manager. The assistant general manager will be *RUSSELL H. GRAY* and the marketing functions of the division will be directed by *JOHN M. BICKEL*, vice president.

All products that enter into air conditioning and industrial refrigeration systems of the central station type will be assigned to the Machinery and Systems Div. This division will be in charge of *GEORGE N. LILYGREN*, vice president and general manager, who will be assisted by *CHARLES V. FENN*, vice president.

The third operating group, Allied Products Div., will include food freezers, unit heaters and other specialty products. *J. L. FLETCHER* will be general manager of this division.

The *CHICAGO PUBLIC LIBRARY* has opened an Applied Science and Technology Dept. This new department brings about the centralization of the library's materials and services in all fields related to applied science and technology. It includes a book collection of more than 20,000 volumes, periodicals and catalogs, and a large section devoted to patent records.

"Mechanical Engineering," a feature length film in color about training, job opportunities and the future in the field of mechanical engineering, has been produced by the School of Engineering at *MICHIGAN STATE COLLEGE*. The film includes scenes of training at the college, and professional engineers at work in Michigan industrial plants.

The *S. MORGAN SMITH CO.* has announced the merger of its wholly owned subsidiary, *R-S PRODUCTS CORP.* of Philadelphia. The Smith company will continue operations under its own name. All sales, engineering and administrative functions have been moved to York, Pa., with

Save Dollars and Days

On Every Job . . . with "A-J"s!

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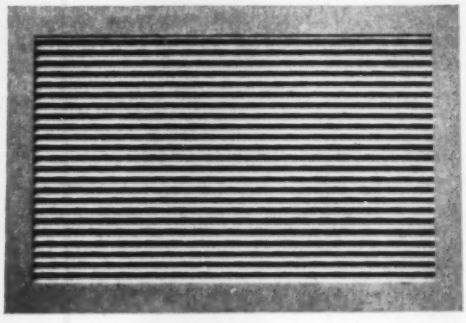
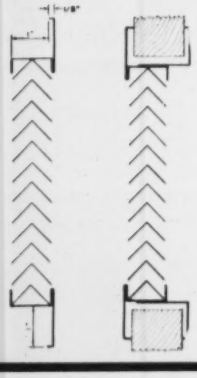
NO-VISION DOOR AND PARTITION GRILLES



AUXILIARY FRAMES FOR *NEAT* — *FAST* — *EASY* INSTALLATION!



This exclusive feature can save you hours on every job! Ends tedious fitting. Special telescoping frame slides over core of grille. Automatically adjusts to fit any door thickness from 1 3/8" to 2 1/2". Gives same neat appearance on both sides.

These famous A-J Grilles are designed to save you time and money on every job. Series 700 (illustrated) Grilles are made entirely from steel. Special inverted "V" shaped louvers are securely set into end frames on 1/2" centers. Metal corners are re-inforced with a metal backing, and spot welded.

A-J Grilles are completely sight-proof from other side, yet allow a maximum circulation of air. They are widely used for exhaust and return air grilles where horizontal, downward deflection is desired.

A-J Grilles are available in a wide range of sizes from 6" x 4" to 60" x 24", as well as special sizes required to fit any job. Grilles are finished in your choice of a variety of finishes: prime, Japan, baked enamel or lacquer.

Find Out Today How A-J Can Save You Time and Money . . . . .

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Listing Over a Thousand Types and Sizes of Grilles For Every Requirement.

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first in 1937 with Blow-Through type evaporative condensers.

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EVAPORATIVE CONDENSERS

FIRST to offer a blow-through type evaporative condenser that functioned with continuous, trouble-free performance—DRAYER-HANSON now introduces a newly designed, improved and greatly expanded line of evaporative condensers that utilize the blow-through feature along with design improvements in leak-proof housing construction, hot dip galvanized eliminators, circulating pumps, sump pan drainage and protective finish. In addition, corrosion and scaling of fans are eliminated because of fan location in the supply air stream. These newly designed units are manufactured with the same DRAYER-HANSON craftsmanship and high quality materials that earned the 1937 model a well-founded reputation for continuous and dependable service—even up to this date. Available in sizes ranging from 5 to 60 tons at 78°W.B.

For further information, write for free catalog, or consult your DRAYER-HANSON Agent today!

LONG *established in commercial refrigeration and air conditioning, DRAYER-HANSON offers a complete line of commercial refrigeration and air conditioning products.*

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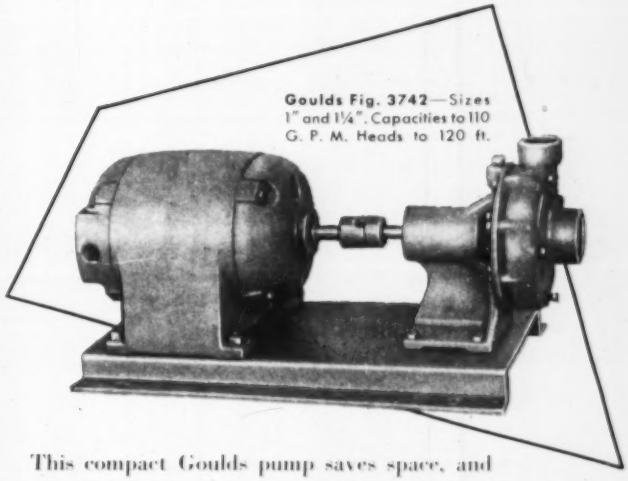
3301 MEDFORD STREET • LOS ANGELES 63 • CALIFORNIA

New Goulds "support head" centrifugal pump

for AIR CONDITIONING installations



Goulds Fig. 3742—Sizes 1" and 1¼". Capacities to 110 G. P. M. Heads to 120 ft.

This compact Goulds pump saves space, and cuts installation, operation, and maintenance costs. It's designed especially for air conditioning installations, but also offers advantages for booster, condensate, and other services.

FLEXIBLE—Discharge may be located in any one of eight positions. May be driven by belt or directly connected to motor or other driver. Drain, vent and priming openings provided.

COMPACT—You can fit this pump unit into virtually any layout.

QUIET—Balanced impeller, the only moving part, assures minimum noise and wear.

SIMPLE—Mechanical seal prevents leakage, but does not bind shaft or require adjustment or periodic maintenance. Vertically split casing permits inspection without disturbing piping connection.

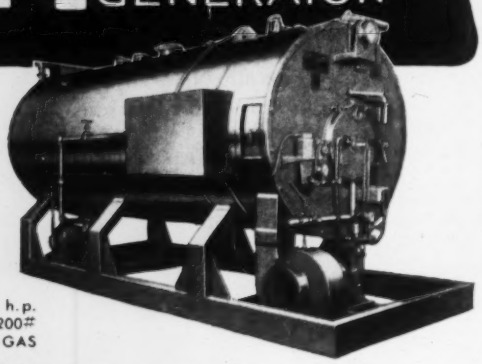
Only change of impeller and casing necessary to convert from one size to the other.

For full details, specifications, performance curves send for Bulletin 625.13.

Goulds PUMPS INC.
Seneca Falls New York

— Just some of the reasons why so many users prefer

AMESTEAM GENERATOR



20 SIZES
10 to 600 h.p.
15 to 200#
OIL OR GAS

— and here are some others:

★ Eye-level controls — protected from dirt, water and accidental damage

★ AMES SERVICE — our **LOCAL** service man starts your unit and provides 3 months' FREE SERVICE

WRITE FOR THIS FREE BULLETIN ON CUTTING STEAM COSTS!

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AMES IRON WORKS INC.

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WE HEAR THAT . . .

sales and engineering being combined with the present Valve Div. *CARL J. WILCOX* will serve as sales manager for the newly consolidated Valve Div.

The *AMERICAN INSTITUTE OF WHOLESALE PLUMBING & HEATING SUPPLY ASSOCIATIONS, INC.* now is offering a series of sales training slidefilms to manufacturers and wholesalers in the heating and plumbing industry. As part of its "Guided Salesmanship" program, the series consists of films and records for eight meetings dealing with the basic principles of selling. Further details are available from the association, 402 Albee Bldg., Washington, D.C.

At the recent National Metal Exposition in Cleveland the *FLEXONICS CORP.* showed samples of several of its new products now in the research and development stage. Among them was stainless steel straight wall tubing for duct systems. The company developed this tubing originally for the aircraft industry to meet requirements for light weight and high tensile strength. New uses now are being found for it elsewhere in industry.

COLORADO FUEL and IRON CORP. recently opened a $30 million seamless tube mill in Pueblo. Covering more than 10 acres under one roof, the plant will turn out more than 150,000 net tons of seamless pipe a year when full production is reached.

Glass pipe, said to be tough enough to drive nails with it, went on tour last month to show the uses of glass piping in industry. The product is "Pyrex Brand Double-Tough" glass pipe, a development of *CORNING GLASS WORKS*. The exhibit is touring in an air conditioned traveling van and within the next year will have visited all 48 states and many of the Canadian provinces.

BENJAMIN FOSTER CO. has recently completed construction of its new general offices at the present plant site, 4635 W. Girard Ave., Philadelphia, providing 1500 sq ft of additional laboratory space for research projects.

WESTINGHOUSE ELECTRIC CORP. is planning to build a multi-million dollar packaged air conditioning plant near Staunton, Va. The new plant will be operated by the Air Conditioning Div., headquartered in Hyde Park, Mass. Expected completion date is June 1, 1954.

EMERSON RADIO and PHONOGRAPH CORP. has acquired a majority interest in *QUIET HEET MFG. CORP.* The Quiet Heet company, which entered the room air conditioning field five years ago, will be operated as an Emerson subsidiary and will continue under existing management. In addition to producing its own line of room and house air conditioners, Quiet Heet will produce the same type of conditioners which will be marketed under the Emerson name.

M&L ...Traditionally
the right equipment for
every Water Heating purpose

When your plans include heating water with live or exhaust steam—when they call for hot water supply to radiant heating panels or other hot water systems—then use M & L equipment.

There are many reasons why M & L equipment is traditionally selected for dependable, uninterrupted service—one of which is the extreme care exercised in assembling, to insure longer service life.

Standardized Flexibility

The unique M & L method of fabrication, which permits custom-built equipment to be made from standardized components at a substantial saving in first cost—fits the equipment to the job to be done.

Send for more details on this worthwhile economy. Please include complete operating conditions in your inquiry to receive an accurate, individual proposal.

1954

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Engineering Co.
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In modern buildings like the

BOSTON FEDERAL RESERVE BANK

correct circulation and distribution of air is a difficult problem. Of major importance is the assurance that the Multi-blade Damper units will operate smoothly and efficiently at all times. The C. P. Blouin Company, Cambridge, Mass., constructed and installed all the Dampers.

Says **Charles Blouin,** *President*

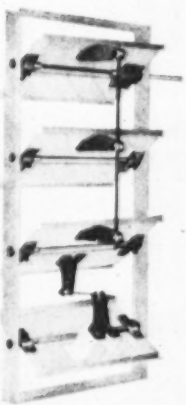
"We are assured of producing as fine a Multi-blade Damper as money can buy because we construct them with...

"DURO-BLADE-KIT"

PRECISION-ENGINEERED

DAMPER HARDWARE

Engineers & Fabricators . . . **when you specify and use the "DURO-BLADE-KIT" you will be assured maximum Damper efficiency.**



Model shows how either parallel or opposed blade action is accomplished.

Check these Important Features:

- Produces highest quality commercial Damper known.
- Self-centering "Duro Bracket" assures smooth, non-binding operation.
- Sturdy, solid construction permits use on heaviest Dampers.
- All materials corrosion-resistant.
- Fits all blades 3 inches or wider. Parallel or Opposed Blade action.
- Easily adjusted even after being installed.
- Excellent for making Approved Fire Dampers.

WRITE for Free Demonstration Kit and illustrated Manual on the construction of "Approved" Dampers

DURO-DYNE CORPORATION Dept. D
38 SOUTH FRANKLIN STREET, HEMPSTEAD, L. I., N. Y.

WHO'S WHAT...

THOMAS K. WELLS has been appointed general sales manager of *FLEXONICS CORP.* Mr. Wells has been with the company 12 years and was most recently sales manager for the Bellows and Aircraft Div. The post of general sales manager is newly created. Since the death in 1950 of A.S. Keller, who was vice president in charge of sales, sales direction has been under a sales executive council.

Other appointments announced by the company are *HOWARD W. GRIESBACH* as assistant sales manager, Bellows Div. and *RICHARD H. SABEL* as sales development manager.

The appointments of *EARL R. MICHEL* as general sales manager of the Air Conditioning and Refrigeration Div. and *PETER A. McLEOD* as product manager of the Centrifugal Refrigeration Section were announced by the *WORTHINGTON CORP.* Mr. Michel has been with the corporation since 1932 and most recently was manager of direct sales. Mr. McLeod joined the firm in 1945 and in 1952 was appointed manager of the Special Processes Section.

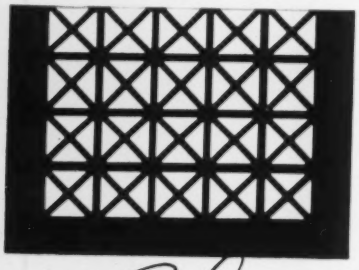
At the 49th annual meeting of the *AMERICAN SOCIETY OF REFRIGERATING ENGINEERS* in Washington in December, one of the events will be the installation of 1954 officers. The officers, elected by letter ballot last month, are: president, *ARTHUR J. HESS;* first vice president, *LEON BUEHLER, JR.;* second vice president, *C. M. ASHLEY;* treasurer, *H. F. SPOEHRER.*

Four new directors to be installed are *R. H. LOCK, FRED P. NEFF* and *A. L. HESSELSCHWERDT, JR.,* who will serve three-year terms; and *G. K. IWASHITA,* who will fill out the unexpired term of Mr. Spoehrer.

Appointment of two staff department heads in the radiator heating and plumbing division of *AMERICAN RADIATOR & STANDARD SANITARY CORP.* has been announced. *E. M. CAMPBELL* has been named manager of sales planning. In this position he will direct programs designed to assist wholesalers, retailers, architects and builders and the sale and specification of the firm's products. *GEORGE A. BEISE* has been appointed manager of market developments. He will be in charge of market research, sales analysis and quota planning. Headquarters of both men will be in the Pittsburgh offices of the company.

ERNEST NUBER has been appointed sales manager, instrument division, of the *BRISTOL CO.* Mr. Nuber joined the Bristol sales engineering organization in 1929. He was made Pacific Coast manager in 1934 and later served for several years as export manager. In 1948 he was promoted to the position of manager of the Application Engineering Dept.

MILTON V. STAGG, assistant to the vice president of the Williams Div. of the *EUREKA WILLIAMS CORP.,*



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Add a touch of beauty and utilitarian design to your decorative motif with Hendrick Perforated Metal Grilles. Your customers will appreciate that extra elegance they add to a room.

Fabricated in sizes with positive, clean-cut perforations and with no burrs or imperfections of any kind, Hendrick Grilles are a cinch to install because they always lie flat — won't bend or warp.

Hendrick Perforated Metal Grilles provide more-than-ample open area for free passage of air flow and they're available in over one hundred attractive designs to choose from in aluminum, bronze, steel or stainless steel. Write for more details, today.

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48 DUNDAFF STREET, CARBONDALE, PA.
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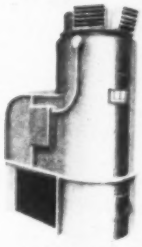
Another direct service of Lee . . . A complete engineering survey of your heating & ventilating problems with a recommended solution made by our highly trained and experienced heating and ventilating engineers is at your demand absolutely free. . . No matter how large or small a project.



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Lee Corporation maintains a skilled staff of engineers to give you complete engineering service in all major branches of engineering—

ELECTRICAL
STRUCTURAL
MECHANICAL
HEATING & VENTILATING
BOILER ROOM
POWER HOUSE
DESIGN

A general office staff is also ready to follow your order promptly and efficiently.

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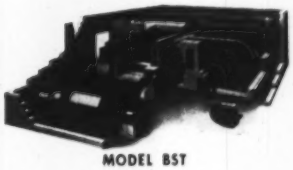
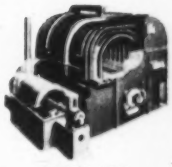


MODEL BST



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The complete engineered heater

LEE

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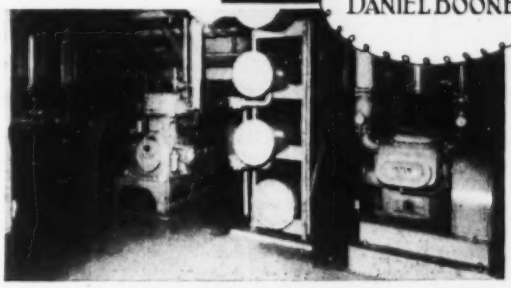


CHECK with VILTER

The Daniel Boone Hotel of Charleston, West Virginia, knows how good Vilter refrigeration is. In 1947, the Daniel Boone switched to Vilter and bought a Vilter twin cylinder vertical freon compressor.

In 1950, The Daniel Boone added a Vilter VMC eight-cylinder compressor.

In 1953, they have added their third Vilter unit, another Vilter VMC eight-cylinder compressor.

In the process, the Daniel Boone has remodeled their equipment room to provide space for two more Vilter compressors, which they expect to purchase as replacement for other units.

It's pretty obvious that the Vilter equipment has cost less to maintain, has given less trouble, and that Vilter has followed through as usual with interest in the job that becomes greater, not less, after the sale has been made.

Vilter refrigeration and air conditioning can do as much for you. Better check Vilter!

Installed by **Commercial Refrigeration, Inc., Huntington, W. Va.**

Vilter®

Your nearby Vilter Representative or Distributor will be glad to show you why so many Vilter users re-order Vilter every time.

REFRIGERATION and AIR CONDITIONING

THE VILTER MANUFACTURING COMPANY
MILWAUKEE 7, WISCONSIN

Air Conditioning • Ammonia & Freon Compressors • Booster Compressors • Baudelot Coolers • Double Pipe Coolers • Blast Freezers • Evaporative & Shell & Tube Condensers • Pakicers • Pipe Coils • Valves & Fittings

FLEXIFLO

ADJUSTABLE

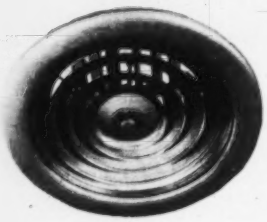
AIR DIFFUSERS

ADJUSTABLE AIR PATTERN | VOLUME CONTROL | DRAFTLESS DIFFUSION

Type R

FLEXIFLO
FOR COOLING

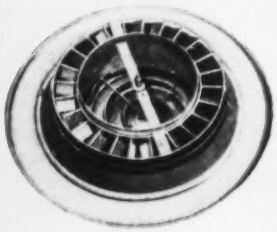
Air travels in a constant pattern parallel to the ceiling regardless of any adjustment in air volume.



Type V

FLEXIFLO
FOR COOLING AND HEATING

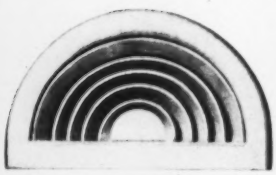
Air diffusion pattern and volume are easily adjustable, after installation, for any conditions, supplying air at any angle.



Type CH

FLEXIFLO
SUPPLY AND RETURN

A combination supply and return outlet made with either the Type R or V blades. Fully adjustable.



Type S

FLEXIFLO
FOR SIDEWALL AND CEILING

Provided with either Type R or V blades to blow air in desired pattern for cooling or heating.

Get the latest Flexiflo technical data on the complete line of better designed, low cost diffusers that meet any required operating conditions.

FLEXIFLO **Universal Diffuser Corp.**
1360 Garrison Ave. • New York 59, N. Y.

WHO'S WHAT . . .

retired recently. A long-standing executive of the concern, Mr. Stagg joined the company in 1934 as manager of the Williams Ice-O-Matic Div. For the past year and a half, he acted as an independent company consultant on matters of company policy.

ELMER H. WEGNER, formerly acting works manager, has been appointed general manager of manufacturing for the *CLEAVER-BROOKS CO.* Mr. Wegner came to the company early this year as director of purchases. He formerly was with the Ladish Co. in this same capacity for 25 years. Assisting him will be *GLENN W. LEUPOLD*, who will be works manager.

DR. MARIA TELKES, noted for her achievements in solar energy including the use of solar energy for heating buildings, has been appointed a research associate in the Research Div. of *NEW YORK UNIVERSITY'S COLLEGE OF ENGINEERING*. She was voted the "Outstanding Woman Engineer of 1952" by the Society of Women Engineers. Dr. Telkes is the designer of the "sun-heated" house in Dover, Mass. The Dover house, which has been occupied by a family for four years, has a chemical heat storage system based on the heat of fusion of low cost materials. Energy from the sun is used for heating the house. Another device cools the house during the summer.

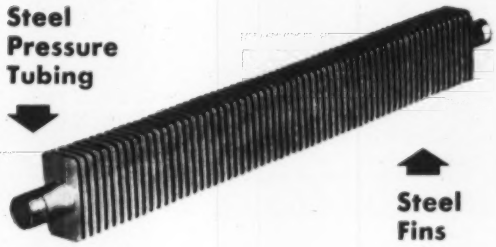
THEODORE W. RUNDELL has been appointed vice president in charge of operations at *SERVEL, INC.* He will have responsibility for production and inspection, engineering and research, purchasing, personnel and labor relations, and product planning. All present personnel in direct charge of these various divisions and functions will remain unchanged. Mr. Rundell has held the position of vice president in charge of engineering since 1952.

Two members of the Servel purchasing division have been promoted. *BYRON GETMAN* now is supervisor of purchasing follow-up. He joined the company's staff in 1942 and moved to the purchasing division from the electric refrigeration division. *LOUIS R. SMITH*, formerly a clerk in the purchasing division, is now buyer of fabricated metal parts, washers, chemicals and outside plating.

JOSEPH E. LINDSAY, formerly research engineer, has been advanced to become assistant manager of the engineering service department of the *NATIONAL RADIATOR CO.* Mr. Lindsay has been with the manufacturer since 1935. He served principally in the company's research department but also acted as chemical engineer in the firm's Plastic Metals Div.

R. B. WEREY, president of *CONOFLOW CORP.*, has announced the promotion of the following members of the company's administrative staff: *RALPH G. HOLBEN*,

STEEL TO STEEL KEEPS FINS TIGHT



Maximum efficiency in finned radiation requires perfect, continuous contact between fins and pipe at all times for only when this contact is perfect will there be maximum heat transfer from pipe to fins and from fins to room air.

AUTORAD uses steel for *both* tube and fins and since the coefficient of expansion of fins and tubing is the same, no amount of expansion or contraction can lessen the bond between them and decrease heat transfer. And no electrolytic action can destroy the perfect bond.

AUTORAD has developed a method of bonding fins to tubing so that the resulting contact is as firm and perfect as a welded joint. As a consequence heat transfer is kept at peak efficiency.

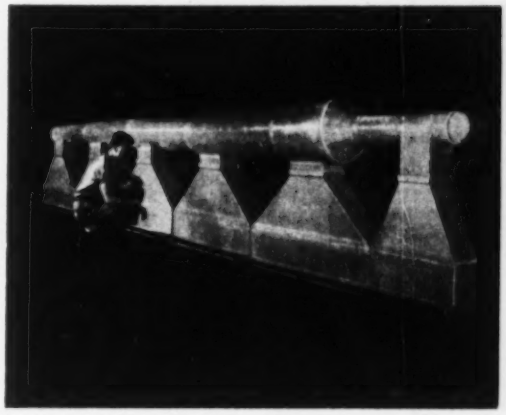
To you as a contractor this means long years of customer satisfaction and customer satisfaction means greater profits to you.

Ask for complete data and prices.

AUTO-RAD Inc.

3535 Fillmore Street, Chicago 24, Illinois

FOR MAXIMUM PROTECTION
From Corrosive Fumes and Liquids



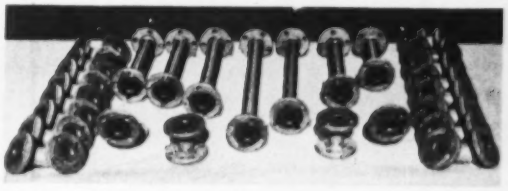
Typical Rigidon Solid Plastic Hood and Duct Sections Ready to Install

SPECIFY *RIGIDON* SOLID PLASTIC EXHAUST HOOD AND DUCT SECTIONS FOR ACID FUME SERVICE

Use Rigidon Solid Plastic Hoods & Ducts

- Excellent Chemical Resistance
- Low Initial Cost
- Light Weight and Maximum Strength
- Wide Variety of Standard Designs

For Your Lined Pipe Requirements



Steel Pipe Lined with Neoprene Rubber for Temperature and Corrosion Resistance.

WRITE TODAY FOR ILLUSTRATED BULLETINS No. 752, 753, and 754 ON SOLID PLASTIC

You are assured longer service life and less maintenance cost by our expert workmanship and unbiased selection of the best lining materials for your specific requirements.

CHEMICAL-PROOF LININGS · TANKS HEATERS PLASTICS

Sales Representatives in All Principal Cities

HEIL PROCESS EQUIPMENT CORPORATION

12901 Elmwood Avenue • Cleveland 11, Ohio

Other Heil Products include: Impervious Graphite Heating and Cooling Units • Lined Storage and Process Tanks • Acid-proof Maintenance Materials • Structural Plastics • Steam Jet Agitators • Lead Fabrication

WHO'S WHAT . . .

former production manager, now is plant manager; *HORACE C. SHUMAN*, former assistant to Mr. Holben, will assume the duties of production manager; and *HAROLD W. BONEKAT* is the new purchasing agent.

N. E. WESTPHAL of Weil-McLain Co. was installed last month as chairman of the Gas Boiler Group of the *GAS APPLIANCE MANUFACTURERS ASSOCIATION*. Mr. Westphal replaces the late A. F. Westerfield of U. S. Radiator Corp., who passed away recently.

WILLIAM J. THOMAS, general sales manager, has been appointed manager of the Tubular Products Div. of the *BABCOCK & WILCOX CO.* and *PAUL J. UTNEHMER*, works manager, has been named to the board of directors of the division.

FRED RICKETTS has recently joined the *O. A. SUTTON CORP.* as sales promotion supervisor. He will integrate the advertising program with actual field sales at the distributor and dealer level. New sales promotion representative is *ROBERT C. TANNER*.

J. C. LINSENMEYER has been elected president of the *AMERICAN BLOWER CORP.*, a division of American Radiator & Standard Sanitary Corp. Mr. Linsenmeyer, who has been with American Blower since 1931, previously had been vice president of manufacturing. *JOHN W. BRENNAN*, formerly chief engineer, is now vice president of engineering.

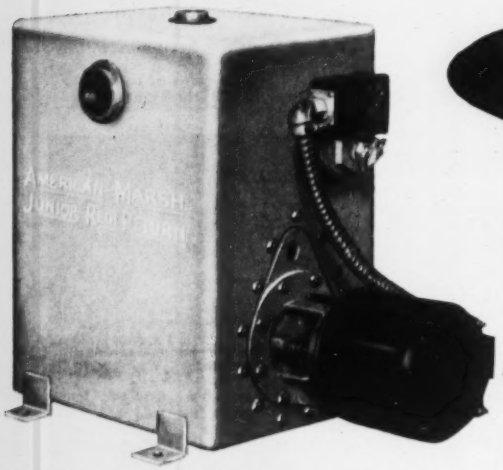
Appointment of *RONALD N. CAMPBELL* as assistant to the president has been announced by *LYLE C. HARVEY*, president of *AFFILIATED GAS EQUIPMENT, INC.* In his new position, Mr. Campbell will coordinate and plan all production including the Bryant Heater Div., Payne Div., and Day and Night Div.

The *COOPER ALLOY FOUNDRY CO.* has announced the appointment of *CLAYTON L. HEINTZ* as manager of distribution. He will coordinate the activities of approximately 1000 distributor salesmen and 50 manufacturers representatives. For the past five years Mr. Heintz has been a branch manager with Ludlow Mfg. and Sales Co.

IN THE TERRITORIES . . .

For *RELIANCE ELECTRIC and ENGINEERING CO.*—*L. E. BLACKWELL, JR.* now is a sales application engineer at the Charlotte, N.C. sales office. The office is located at 1208 Liberty Life Bldg.

For the *RITTLING CORP.*—A midwest regional sales office has been opened at 7001 N. Clark St., Chicago. It



SIZE 1—To 5,000 sq. ft. radiation at 20 lbs. discharge pressure—18,000 sq. ft. at 8 lbs. pressure.

SIZE 2—To 9,000 sq. ft. radiation at 30 lbs. discharge pressure—18,000 sq. ft. at 20 lbs. pressure.

AMERICAN-MARSH PUMPS
BATTLE CREEK MICHIGAN
In Canada:
American-Marsh Pumps (Canada) Ltd., Stratford, Ont.

7 TIME-TESTED FEATURES PUT YOU AHEAD

when you install AMERICAN-MARSH Junior Redi-Return Condensation Units

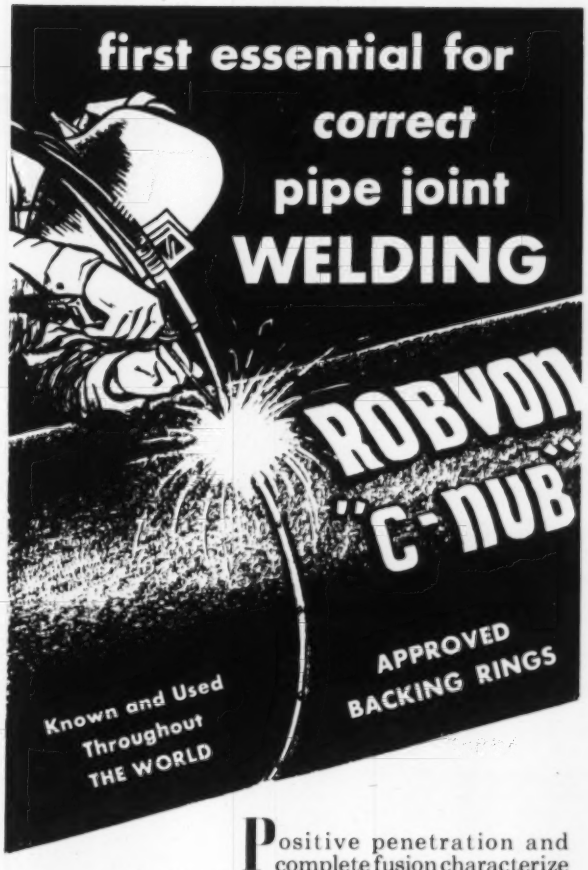
You're *'way* ahead when you *please* the "man who pays the bills." To be *sure*, install this Junior Redi-Return Condensation Unit. Well designed—rightly priced—it gives low-cost, trouble-free service in hotel, store, school and apartment heating systems. These time-tested "Junior" features show why:

1. Bronze-fitted pump—balanced, enclosed bronze impeller.
2. Pump is inside tank—saves floor space.
3. Easy to install—no special foundation.
4. Remove working parts from tank without disturbing pipe connections.
5. No lubrication ever needed.
6. Heavy, 16 gallon copper-bearing steel tank—high and low inlets.
7. Drip-proof ball-bearing capacitor motor—heavy-duty float switch.

And there's more—we'll gladly supply full performance data, dimensions and details . . . **Write for Junior Redi-Return Bulletin 425.**

Pumps and Pumps Only Since 1873

CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR TESTING, PROCESSING, BOILER FEED, FIRE PROTECTION, ETC



Positive penetration and complete fusion characterize welds made with ROBVON "C-NUB" Approved Backing Rings—the most economical "tool" a welder can use.

SAVES MORE THAN 50% fit-up preparation—SAVES materials—SAVES on maintenance and replacement costs.

100% EFFICIENCY—Time, Labor and Materials. **PERFECTS JOINTS—PERFECTION PROVED** by X-Ray, Radiograph or Gamma Ray inspection.

PROVE IT TO YOURSELF. One trial will prove to you the many reasons why ROBVON "C-NUB" Approved Backing Rings have been "Standardized" on by the best Fabricators, Weld Fitting Manufacturers, Designers, Consultants, Public Utilities, Shipbuilders, Refiners, Chemical, Textile and other large Industrial users, Boiler and Turbine manufacturers, and many others. Approved by USCG, USMC, AWS, PFI, ABS and other U. S. Government agencies.

Iron Pipe and Spiral-Weld Pipe and Tube sizes—¾" to 60". "NUB" Spacer Root Openings are ⅛", 3/16" and ¼".

TRY THEM—YOU'LL BE GLAD YOU DID.

Send for Catalog and Data Sheets.

ROBVON Industries, Inc.
675 GARDEN ST., ELIZABETH, N. J.

SCHOOLS

require

safe, dependable

air distribution

•

You are assured

FAULTLESS OPERATION

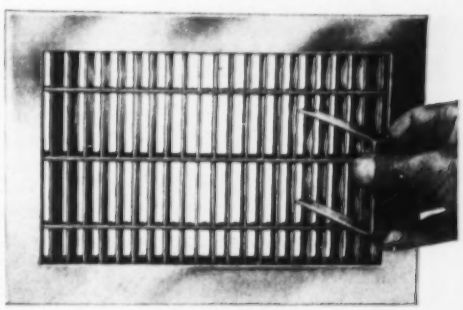
RUGGED CONSTRUCTION

when you Specify and Install

R & G

Tamperproof Kickproof

REGISTERS and GRILLES



R & G Style 120, Chromium plated, Solid Bars with Interlocking Cross Bars (fixed or adjustable).

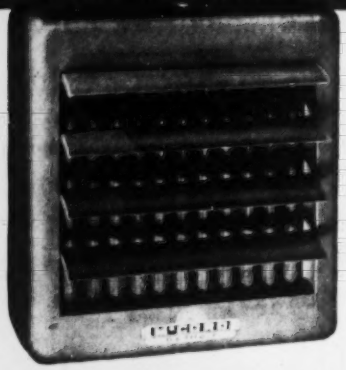
Complete Line of Registers and Grilles for
HEATING • VENTILATING • AIR CONDITIONING
Catalog on Request

REGISTER & GRILLE MFG. CO., INC.
70 BERRY STREET, BROOKLYN 11, N. Y.

McCORD

HEATING AND AIR CONDITIONING PRODUCTS

HORIZONTAL TYPE UNIT HEATERS



Modern design—top performance—thousands in use—dependable heat. All copper coils to resist corrosion — individual tube expansion — most rugged construction — quiet operation — easy installation—standard motors with standard bases. Sizes to 272,000 B.T.U. capacity.

VERTICAL TYPE UNIT HEATERS

A proven heating unit—all copper coils to resist corrosion. McCord spiral tube fin construction creates air turbulence without undue restriction. Improved fan delivers large volume of air, with minimum air noise. All McCord heaters are guaranteed for use with 150 lbs. saturated steam pressure. Sizes to 575,000 B.T.U. capacity.

McCORD CORPORATION
DETROIT 11, MICH.

WHO'S WHAT . . .

is headed by *FRED W. THOMPSON* and *FRANK W. HELIKSON*. Additional sales representatives are now being added to serve the central area.

For *HEIL PROCESS EQUIPMENT CORP.*—*RICHARD F. PROTIVA* is a district sales engineer for the Cleveland corporation. Mr. Protiva will be responsible for all sales in the eastern portion of the home territory.

For *A. O. SMITH CORP.*—New distributor in the West Coast area is *U.S. STEEL SUPPLY DIV.* of *U.S. STEEL CORP.* The distributor has warehouse facilities at Los Angeles, San Francisco and Portland, Ore. The supply division also distributes Smith welding products in Chicago, Pittsburgh, St. Paul, St. Louis, Baltimore, Newark and Boston.

For *UNITED STATES RUBBER CO.*—*BROWNELL DISTRIBUTORS, INC.*, 208 Canal St., New York, has been appointed the distributor for "Uskon" electrical radiant heating panels. Brownell will cover seven counties in lower New York state.

For the *NATIONAL RADIATOR CO.*—*GERALD R. COX* is now the sales representative in northern California and Nevada. His headquarters are at the company's Pacific branch, 681 Market St., San Francisco.

For the *TRANE CO.*—*JOHN G. HAMM* is the new manager of the St. Louis sales office. For the past seven years he has been associated with the firm's St. Paul office.

The company also announced the new locations of two sub-offices of the Greensboro, N.C. sales office. The Charlotte office, managed by *LOY F. THOMPSON*, is located at 531 Northgate Ave. The address of the Raleigh office is 510 Rose Lane. *BANKS W. CLARK* is sales manager.

For *YOUNGSTOWN SHEET and TUBE CO.*—*PERCY L. MacGOWAN* is Chicago district engineer. He succeeds H. C. Williamson, who has retired.

A. H. PRASSE, general manager of *CRANE CO.* branches, has announced moves affecting personnel of four of the company's midwest branches. *ALFRED N. ROSBOROUGH*, manager of the Cleveland branch since 1945, has been transferred to the Omaha branch as manager. He succeeds his brother, *C. J. ROSBOROUGH*, who is retiring. Promoted to the Cleveland vacancy is *THOMAS D. KELLY*, who has headed the East Chicago, Ind. branch since 1945. The new manager at East Chicago is *CHARLES M. McDERMOTT*, assistant manager of the Crane branch at Detroit since 1947.

For *EDWARD VALVES, INC.*—*H. W. BIERMAN* is sales engineer for the territory comprising the state of

Oh! WHERE... *is my wandering ad tonight?*

THERE are two ways to buy advertising space. One is the guesswork-opinion method. The caption above is the mournful song of an advertiser who is still selecting media the way it was done before World War I, when there were no standards for the circulations of published media and when there was no accepted and approved method of auditing circulations. In those days, advertisers O.K.'d their proofs and sent out their advertising with a prayer that some of their sales messages would find their way to market.

The other way to buy space is the factual, know-what-you-get-for-your-money method. Today advertisers can start their investments on a basis of facts by selecting media with the help of the information in the reports issued by the AUDIT BUREAU OF CIRCULATIONS. This cooperative and nonprofit association of 3300 advertisers, advertising agencies and publishers, organized in 1914, has established standards that make it possible to evaluate the circulations of published media. The A.B.C. maintains a large staff of experienced and specially trained circulation auditors who make annual audits of the circulations of publisher members. A.B.C. reports give the facts thus obtained.

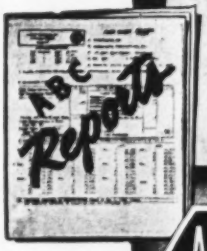
Here are some of the audited facts about business papers that A.B.C. reports tell the advertiser:

—how much paid circulation;
—how much unpaid;
—an occupational or business breakdown of subscribers;
—where they are located;
—how much subscribers pay;
—whether or not premiums are used;
—how many subscribers are in arrears;
—what percentage of subscriptions are renewed.

Those who buy advertising on the basis of this factual information, as given in A.B.C. reports, do not have to speculate about the distribution of their sales messages. They KNOW where and to whom their advertising goes. That is why this business paper is a member of the AUDIT BUREAU OF CIRCULATIONS. Ask for a copy of our A.B.C. report and then study it.

SEND THE RIGHT MESSAGE TO THE RIGHT PEOPLE

Paid subscriptions and renewals, as defined by A.B.C. standards, indicate an audience that has responded to a publication's editorial appeal. With the interests of readers thus identified, it becomes possible to reach specialized groups effectively with specialized advertising appeals.



ABC

Heating, Piping & Air Conditioning

A. B. C. REPORTS—FACTS AS THE BASIC MEASURE OF ADVERTISING VALUE

Taylor controls Weather made by "Climate-Lab!"*

Both humidity and temperature are precisely controlled in the "Climate-Lab" test apparatus, developed and marketed by the American Instrument Company, Silver Spring, Md. The control system employs a Taylor Time Schedule Double Duty Recording Controller, whose control settings are varied automatically by shaped cams to produce various time, temperature and humidity programs. It also provides a minute-by-minute chart record.

This apparatus is equally adaptable to research, development or production. Among its many applications are: testing various types of equipment and containers; checking products destined for government use to insure compliance with specifications; testing packaging of food and other products for resistance to or retention of moisture; atmospheric corrosion studies; research on the effects of climatic conditions on seeds, plants, animals, etc.

Taylor has the instrumentation and the know-how to provide the answer to many tricky problems in the field of air-conditioning. Ask your Taylor Field Engineer or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

*TRADE-MARK PENDING

TAYLOR INSTRUMENTS MEAN ACCURACY FIRST

WHO'S WHAT . . .

Oklahoma and parts of Missouri, Kansas, Arkansas and Texas. Mr. Bierman, formerly located at the Edward home office, will make his headquarters at the Rockwell Mfg. Co. offices in Tulsa.

The Automatic Control and Uni-Flo Divisions of the *BARBER-COLMAN CO.* have opened two new factory branch offices, one in Indianapolis and the other in Omaha. The manager of the Indianapolis office, located at 1537 Central Ave., is *DON HORACK*. *TOM PETERSON* will manage the Omaha office at 1245 S. 13th St. Both offices will handle sales and service of automatic control and air distribution products.

For *SNAP-TITE, INC.—RUSSELL J. SMITH* has been appointed sales representative for the states of Illinois, Kentucky and Missouri. Offices are at 1601 Grand Blvd., St. Louis 4, Mo.

For *MARLOW PUMPS—WILLIAM MAXWELL* has been appointed sales engineer for the company's New England territory. Mr. Maxwell succeeds *WILLIAM VAN BLARCOM*, who was recently made general manager of the plant at De Queen, Ark. Mr. Maxwell's headquarters are in Natick, Mass.

For *WILLIAMS DIV.* of the *EUREKA WILLIAMS CORP.—VICTOR E. REED* is field sales representative in the Boston metropolitan area. With headquarters at Haverhill, Mass., Mr. Reed's territory includes all of Rhode Island, except for the city of Westerly and a ten-mile radius; and several counties in Massachusetts and Connecticut.

For *FARR CO.*—A southern division sales office has been established in the Sterick Bldg., Memphis, Tenn. *DONALD HARWORTH*, southern division sales manager, is in charge of the new office.

For the *TRANE CO.*—Three new representatives assigned to field sales offices are: *RAYMOND O. GOODMAN*, Chattanooga office; *ROBERT E. MURPHY*, Milwaukee; and *RICHARD E. HASKINS*, Oklahoma City.

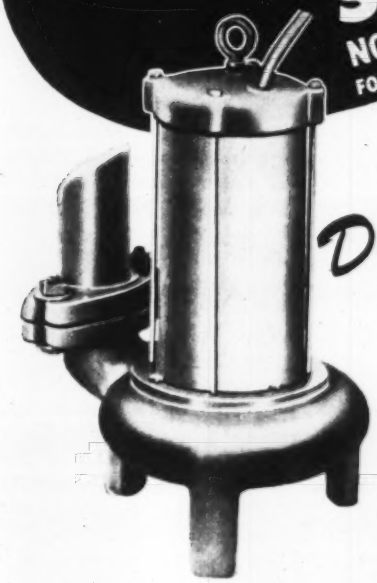
For *HEIL PROCESS EQUIPMENT CORP.—KEN W. GRADER* has been appointed Chicago district representative with headquarters at 400 W. Madison Ave. During the past three years he has been sales engineer in the eastern home territory.

For *CLEAVER-BROOKS CO.—D. E. McCULLEY CO.* of Omaha now is exclusive manufacturer's representative for the company's boiler equipment. Located at 1903 Jones St., Omaha 2, the McCulley Co. will handle a territory consisting of western Iowa and central and eastern Nebraska.

weil SUBMERSIBLE

NON-CLOG SCREENLESS SEWAGE EJECTOR

FOR NEW INSTALLATIONS — FOR REPLACEMENT INSTALLATIONS



Pumps ALL Sewage

From Disposals • From Laundry Trays • All Household Sewage
All Industrial Sewage • All Rags and Stringy Materials
The Submersible handles anything that will pass through sewage lines

Designed

- **To operate UNDERWATER**
- **for BELOW floor level installation**
- **for installation in LIMITED SPACE**
- **for DUST-PROOF operation**

Capacities: 35 to 300 G.P.M. Heads to 45 feet

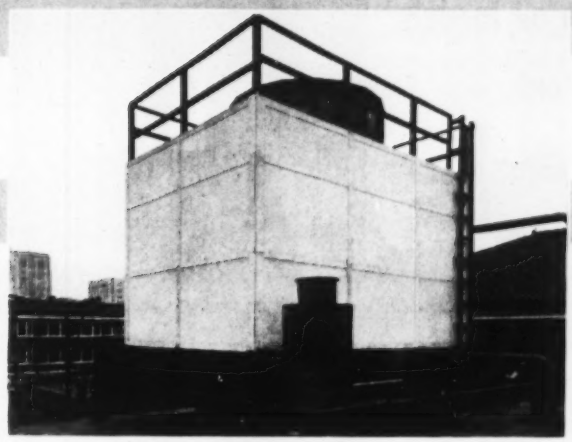
Stocked by your Jobber

For Residential Installation—3" discharge—½-¾-1 HP. See Bulletin SE 850
Dimensions: Dia. 17"; Hgt. 25"
For Heavy Duty Installation—4" discharge—1½-2-3 HP. See Bulletin SE 860
Dimensions: Dia. 23"; Hgt. 28"
For remodeling applications send for Bulletin SE-870

A one horsepower unit handles waste from 20 residences

weil PUMP COMPANY • 1520 N. Fremont St. Chicago 22, Illinois

ANOTHER BIG AIR CONDITIONING JOB



Protected by a UNITED COOLING TOWER

Contractors chose this United tower for the air conditioning system of one of the country's largest newspapers. It is one of many similar United installations in air conditioning service throughout the country. Others, in any desired type or capacity, are available on a competitive performance and price basis. Be sure to let United figure with you.

UNITED COOLING TOWER COMPANY
4022 Broadway, Kansas City 2, Mo. Plant: Pilot Point, Texas
Authorized representatives in Principal Cities

Piping Problems?

For Fast Economical Installation and Longer Service Life...

Specify RIC-WIL Prefabricated Insulated Piping Systems

Fast Economical Installation — Ric-wiL systems are prefabricated under ideal factory conditions leaving a minimum of work to be done in the field. Ric-wiL engineering service provides complete technical data and detailed working drawings — assuring rapid and accurate installation.

Longer Service Life — Ric-wiL systems are factory prefabricated on precision machines — all operations are carefully controlled eliminating chances for faulty workmanship to cause service failure.

Whether your problem involves underground or overhead piping — extreme temperatures or corrosive products — if proven insulated piping systems are required . . . it will pay you to call in your Ric-wiL representative as early as possible in your planning.

Ric-wiL PREFABRICATED INSULATED PIPING

UNDERGROUND OR OVERHEAD

THE RIC-WIL COMPANY • BARBERTON, OHIO

NEW BOOKS & REPORTS...

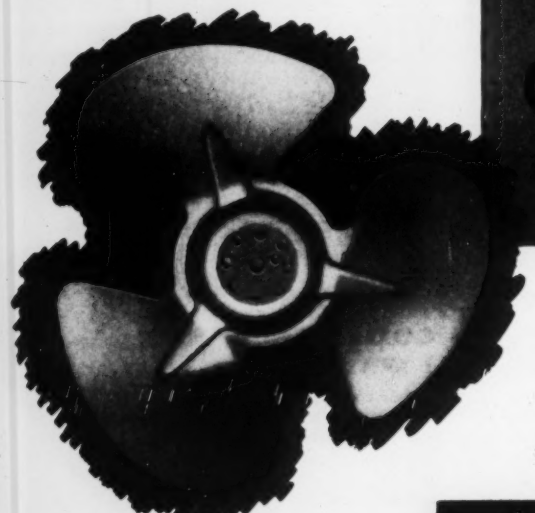
Heat Emission of Perimeter Ducts

Heat Emission Characteristics of Warm-Air Perimeter Heating Ducts is the report of an investigation conducted in the Floor Slab Laboratory at the University of Illinois. The study was done by John R. Jamieson, Robert W. Roose, Herbert T. Gilkey and Seichi Konzo, all members of the Dept. of Mechanical Engineering.

The Floor Slab Laboratory is a 72 x 16 ft insulated structure built to facilitate the study of heat transfer characteristics of concrete floor slabs heated by means of an 8-in. diameter perimeter duct. Specifically, studies were made to determine: temperature drop of air flowing through ducts embedded in the concrete floor; magnitudes and distribution of the heat losses to the ground and through the edges of the floor slab; effect of floor coverings on the heat transfer characteristics of the floor slabs; heat transfer lag and response of the mass of concrete and earth surrounding the perimeter duct; effect of windows on the temperatures within the rooms; air delivery into rooms through registers; and durability of materials for edge insulation. This investigation was conducted in cooperation with the National Warm Air Heating and Air Conditioning Association.

Each chapter describes the procedures used in the various tests and a summary of results. Many graphs are used to show these results. The results are summarized in the form of practical design data in terms of: net heat emission from the floor surface; air temperature drop

Designed for use on all models of unit bearing motors . . .



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★ Set and aligned to assure uniformity of product
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★ Available in clockwise and counterclockwise rotation
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★ Diameter sizes: 7¾, 8¾, and 10 inches

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ALL TRAPS are NOT ALIKE

1. It compensates for changes — operates satisfactorily even if pressures vary.
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The ¾" 69B FLOAT and THERMOSTATIC TRAP

Ideal for installation and rehabilitation of unit heaters. Dependable, compact, large capacity, easy servicing and rugged construction makes 69B an outstanding performer on unit heaters and other steam heating equipment.

Install **the most convenient Way**

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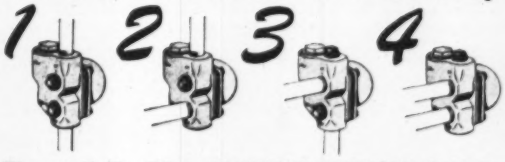
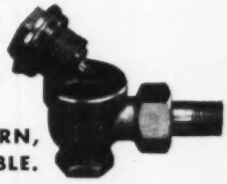


The ½" 7–50A ANGLE RADIATOR TRAP



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STEAM HEATING is MODERN, EFFICIENT and DEPENDABLE.

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Get DOUBLE* PROTECTION for your oil burner installations with . . .

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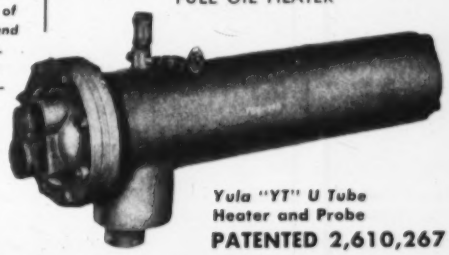
FUEL OIL HEATER

Approved *by New York City Board of Standards and Appeals. No. 367-50-S.A.*



Yula "YT" U Tube Heater and Probe

PATENTED 2,610,267

* **Protects system from serious damage, in case of an oil leak in the Pre-heater, by shutting off oil burner, sounding an alarm, flashing on a red light.**
* **Acts as a Low Water Cut-off**

RESULT: Heating System protection at low cost

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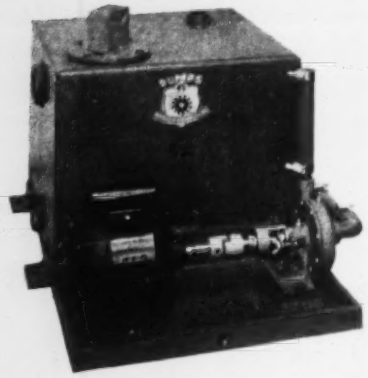

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Other models are available with capacities to 100,000 sq. ft. at 200 psi. Mail coupon today for free descriptive literature.

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NEW BOOKS & REPORTS . . .

through the embedded ducts; and subfloor heat losses.

The bulletin is available from the Engineering Experiment Station, University of Illinois, Urbana, at 80 cents a copy.

Standards for Cast Iron Pipe

After 27 years of experiment and research, the American Standards Association has published nine new standards for improving cast iron pipe. The new standards provide uniformity in methods of determining the thickness and length of cast iron pipe, depending upon the pipe's diameter and the pressure it must withstand. These specifications, dealing with both spun pipe and cast or molded pipe, also include data on reasons for failure of cast iron pipe and methods for preventing corrosion. The standards were developed under ASA Committee A21, which was formed in 1926 to undertake this project. Committee chairman since that time has been Thomas H. Wiggin, consulting engineer.

The standards on cast iron pipe and fittings may be obtained from the American Standards Association, 70 E. 45th St., New York 17, at the following prices:

Cast Iron Pit Cast Pipe for Water or Other Liquids, 45 cents; *Cast Iron Pit Cast Pipe for Gas*, 25 cents; *Cement Mortar Lining for Cast Iron Pipe and Fittings*, 35 cents; *Cast Iron Pipe Centrifugally Cast in Metal Molds, for Water or Other Liquids*, 40 cents; *Cast Iron Pipe Centrifugally Cast in Metal Molds, for Gas*, 25 cents; *Cast Iron Pipe Centrifugally Cast in Sand-Lined Molds, for Water or Other Liquids*, 45 cents; *Cast Iron Centrifugally Cast in Sand-Lined Molds, for Gas*, 25 cents; *Short Body Cast Iron Fittings*,

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Here is a standard diaphragm regulator that can handle your special pressure control requirements. It is furnished in a wide range of sizes, types (self-contained, instrument or pilot control), bodies, and trim, to your specification. For water, oil, steam, air or gas. No. 119 single seated, No. 114 double seated, sizes ½" to 6", screwed, standard or extra heavy flanged. Direct or reverse acting. Tested and approved by leading engineers and contractors — the answer to your regulator problems.

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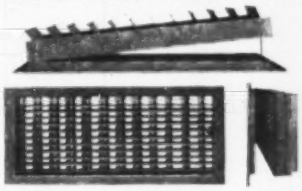
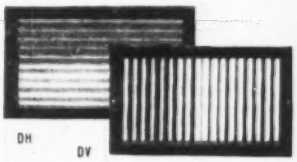
In this Complete Catalog . . .

For Quality, Originality, Economy and Fast Delivery—your best choice is Stewart for Industrial and Commercial Registers — Grilles and Air Controls. You'll find one to suit your every need in the new 28 page Catalog #53.



SCOOPMASTER
Eliminates sheet metal collar—directs and controls air



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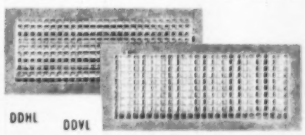

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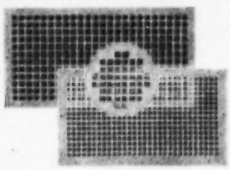
Opposed-Action Valves
optional with all Supply and Return Air Registers.



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Deflects and controls the air from a supply duct into a collar

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Upjohn gets "baker's dozens"

Air moisture — troublemaker in many processes — could play havoc in the processing of "Gelfoam," Upjohn's sponge-like material for the control of bleeding in surgery. Kathabar humidity conditioning helps provide Upjohn with *"baker's dozen" production* by delivering uniformly dry air to Gelfoam baking ovens — cutting drying time, saving fuel, and maintaining product quality and uniformity.

This is just one of the numerous instances in which Kathabar's direct dehumidification is cutting costs in the chemical process industries. Manufacturers of plastics, petrochemicals, pharmaceuticals, rubber, photographic film, military powders, and many other materials use Kathabar air conditioning for production, packaging and storage. Installations range up to more than one hundred thousand cfm in capacity.

Look into Kathabar humidity conditioning now as a "straight line" to "perfect weather" production every day. Write for literature Group K-53-3, on your letterhead, please.

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ALSO MAKERS OF
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3 inch to 12 inch, for 250-psi Water Pressure Plus Water Hammer, 35 cents; and *A Mechanical Joint for Cast-Iron Pressure Pipe and Fittings*, 35 cents.

Standards for Steam and Hot Water Coils

Tentative Standard Code for Testing and Rating Steam Coils, Bulletin 200, has been issued by the Heating and Cooling Coil Manufacturer's Association. These standards provide definitions, a description of apparatus, general test procedure, nomenclature, formulas, calculations and graphical representation of results. Similar standards for testing and rating hot water coils are given in Bulletin No. 201.

The Heating and Cooling Coil Manufacturers' Association is located at 2159 Guardian Bldg., Detroit 26.

OTHER BOOKS AND REPORTS

REVIEW OF ASTM RESEARCH—reprint of the review as published in the December 1952 and January and February 1953 ASTM Bulletins. The material summarizes the work of the various technical committees of the society as of May 1953.

Copies of this 22-page pamphlet are available, without charge, from the headquarters of the American Society for Testing Materials, 1916 Race St., Philadelphia 3.

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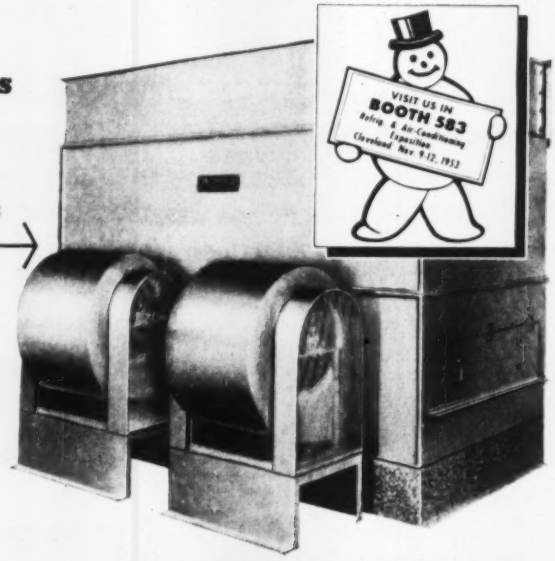
where Cooling Towers must be QUIET...

specify Binks new Series "B" Towers



Binks Series "B" Mechanical Draft Towers are establishing new performance standards for NOISE-FREE operation because they employ squirrel-cage blowers operating at slow speeds. Their design also provides much simpler maintenance because the operating parts are located in the DRY AIR stream—never come in contact with corrosive, moist exhaust air.

Available in capacities from 1 to 108 tons, Binks Series "B" Towers are ideal where quiet operation is essential—for example, hospitals, hotels, apartment buildings, private homes, commercial establishments, etc.

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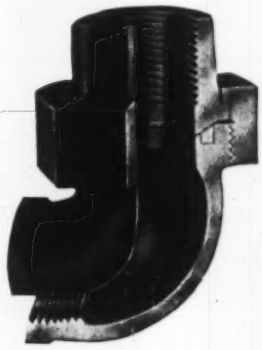

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2. Do they have octagonal ends for easy tightening by any type wrench?
3. Are they *plainly marked* for 300# pressure?
4. Are they made of Air Furnace Malleable Iron with a tensile strength of 55,000 p.s.i. and air tested before shipment?

If you can't answer "Yes" to *all* these questions, you're not using

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. . . . and you're not taking advantage of all these features which are back of Jefferson's reputation for high quality, maximum service and economy at a slightly higher cost.

The Jefferson line includes: WOG 2000# to 2" and 1000# to 4" in Jefferson 300# brand straight through unions, union ells and union tees; flange unions; AAR male and female unions: Enduro 300#, Excel 250 # and Master 150# unions. All types also available with all-iron seats. Underwriters approved.

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These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.

Standard material Brass. Also available in Stainless Steel and Monel. Pipe sizes from ⅛" to 1". ¼" size is 1-5/16" long and made from ⅜" square stock.

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PRECISION Engineered ...for air conditioning and hot water circulating!

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Get the facts!

Before you buy any centrifugal pump, read bulletin JGP-2.

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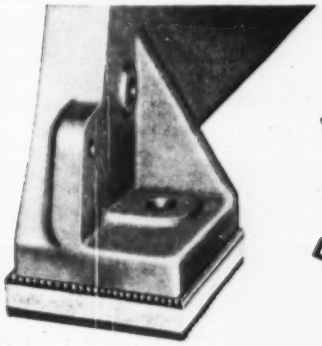

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LOW COST

Elasto-Rib effectively stops transmission of vibration and noise by utilizing the elastic and damping properties of both cork and rubber.

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from fire. Included are sections on the prevention of dust explosions, gas piping and appliances, liquefied petroleum gases and mechanical refrigeration and welding and cutting.

The 1953 edition is available from the National Board of Fire Underwriters, 85 John St., New York 38.

SELECTED VALUES of PHYSICAL and THERMODYNAMIC PROPERTIES of HYDROCARBONS and RELATED CARBONS—Comprising the Tables of the American Petroleum Institute Research Project 44 as of December 31, 1952. The book has been published for the American Petroluem Institute by the Carnegie Press, Carnegie Institute of Technology, Pittsburgh. It is priced at $7.00 a copy.

PROCEEDINGS of the AMERICAN POWER CONFERENCE—proceedings of the conference sponsored by the Illinois Institute of Technology, March 25-27, 1953. Of special interest in the section on Mechanical Sessions are a Symposium on Industrial and Institutional Plant Operation and a session on Problems of Fuel Conversion. Papers reprinted from the Heating and Air Conditioning Sessions are under the following headings: Heating of Modern Homes; Heat Pump Research and Applications; Residential Air Conditioning; and Residential and Commercial Heat Pumps.

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"We found that Dy-Namic Balancing of cooling fans reduces vibration, lessens bearing wear and noise, and results in greater customer acceptance of our products."
"When blower wheels are balanced STATICALLY only, DY-NAMIC unbalance is often increased . . . that's why we use the 'Bear' method, which takes care of both static and dy-namic balance in one operation."

Like hundreds of other industrial plants, Morrison Products Company has discovered that "Bear" Dy-Namic Balancing Machines attain high standards of accuracy at favorable production rates and with minimum capital investment. Reduce noise, vibration, friction, bearing failure thru Dy-Namic Balancing. **FREE MANUAL** shows how! Write: Bear Mfg. Co., Dept. H-16, Rock Island, Ill.

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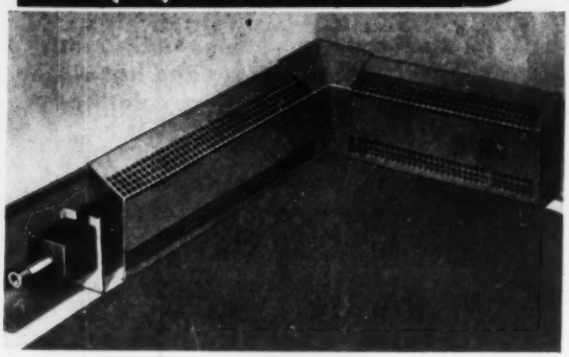
"BEAR"
STATIC AND *DY-NAMIC BALANCING* MACHINES
balance rotating parts weighing from 4 oz. to 8 tons

New Design **"Floor-Level" BASEBOARD CONVECTOR**



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  Rugs laid up to — not under — cover
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  Keeps walls clean
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  New snap-on element hangers solve field alignment problems.

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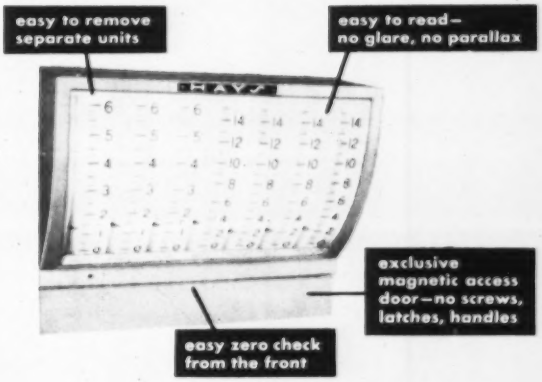
easy to remove separate units
easy to read— no glare, no parallax
exclusive magnetic access door—no screws, latches, handles
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a new draft gage!

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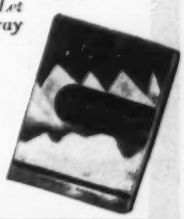

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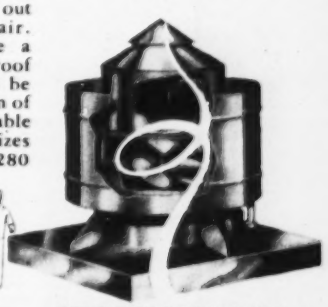
MUCKLE VENTS CAN HELP YOU

No problem too tough—whether your air is London Fog thick or Sahara Dry—gaseous or dusty—smoky or hot . . . MUCKLE VENTS remove it quickly and efficiently. These streamlined, propeller-driven, roof-mounted ventilators are designed with motor out of the air stream to effectively pull out either wet or dry air. MUCKLE VENTS are a completely weatherproof packaged unit ready to be installed with a minimum of expense and work, available in wide range of 15 sizes from 254 CFM to 10280 CFM.



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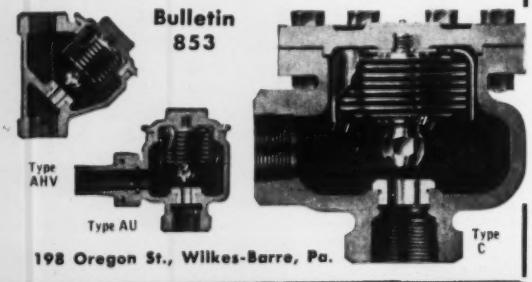

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HEAT AND MOISTURE PRODUCTION OF LAYING HENS— preliminary results obtained from the study conducted with the poultry respiration calorimeters of the Div. of Farm Buildings and Rural Housing, U.S. Dept. of Agriculture. The paper presents the effect of temperature, humidity and other environmental variables on egg and meat production. Also presented are heat, moisture and ventilation problems encountered in poultry housing.

The article first appeared in Agricultural Engineering, published by the American Society of Agricultural Engineers, Saint Joseph, Mich.

RULES AND REGULATIONS FOR THE INSTALLATION, MAINTENANCE AND USE OF PIPING, APPLIANCES AND FITTINGS FOR GAS— complete revisions published by the Dept. of Public Utilities, Richmond, Va. Included in the revisions are sections outlining the responsibility for payment of the cost of relocating gas meters and elimination of the interior trap door requirement for floor furnace installations. In addition the detailing of conversion burner test requirements has been omitted.

The Dept. of Public Utilities is located at 900 E. Broad St., Richmond 19, Va.

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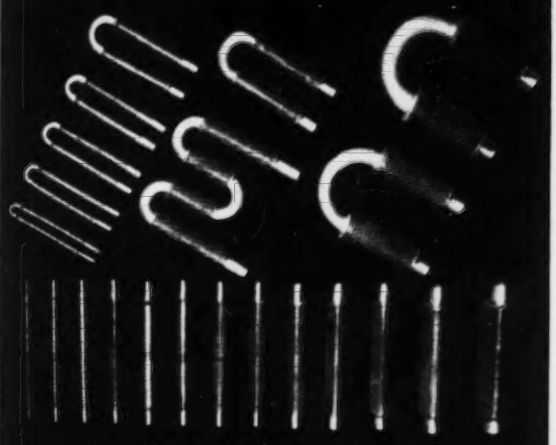

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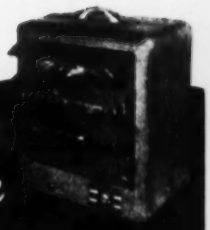

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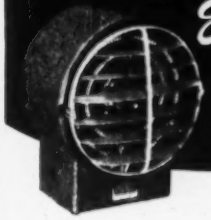

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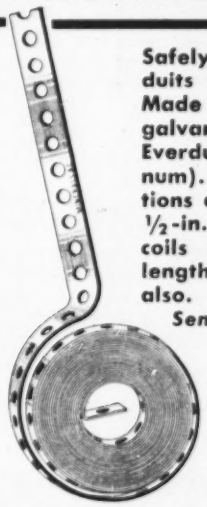

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EIGHTH ALL-INDUSTRY REFRIGERATION AND AIR CONDITIONING EXPOSITION, 1346 Connecticut Ave., N.W., Washington 6, D.C. — November 9-12, Cleveland Public Auditorium, Cleveland. Emphasis will be on marketing opportunities for retail establishments.

NATIONAL ASSOCIATION PRACTICAL REFRIGERATING ENGINEERS, 435 N. Waller Ave., Chicago 14—44th annual convention, November 10-13, Purdue University, West Lafayette, Ind. Guest of honor is Prof. H. G. Venemann, retiring professor of refrigeration.

IBR SCHOOL OF MODERN HEATING—Fall and early winter schedule includes schools in Scranton, Pa., Koch Conly Post American Legion, 415 N. Washington St., November 17-19 and in Providence, R.I., Providence Gas Co. Auditorium, December 1-3. Tuition is $28. Those wishing further information may obtain it from the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17.

NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOCIATION, 115 Public Sq., Cleveland 14—40th annual convention, December 2-3, Hotel Cleveland, Cleveland. The convention will commemorate four decades of association service to the central warm air

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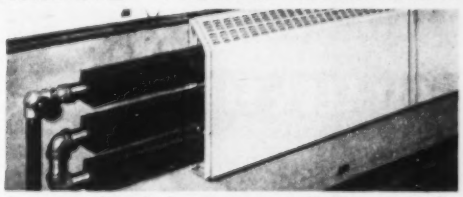

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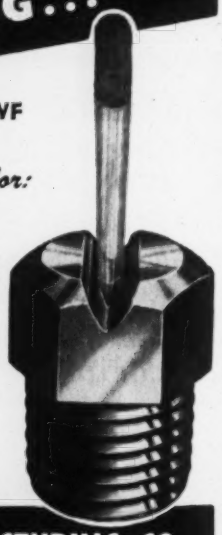

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AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, 40 W. 40th St., New York 18—49th annual meeting, December 6-9, Shoreham Hotel, Washington, D.C.

NATIONAL CONSTRUCTORS ASSOCIATION, 50 E. 41st St., New York—annual meeting, January 12-14, Hotel Commodore, New York. The association is composed of firms engaged in the design and construction of chemical plants, steel mills and petroleum refineries.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York 13 — Annual Meeting, January 24-27, 1954, Rice Hotel, Houston, Texas. See pages 155-157 for further details.

PLANT MAINTENANCE & ENGINEERING CONFERENCE AND SHOW—fifth annual meeting, January 25-27, 1954, Chicago. The conference will be held at the Hotel Conrad Hilton and the show will be at the International Amphitheater. Industries to get special attention include sheet metal, power and mechanical service equipment. The meeting will be divided into three general sessions, 16 sectional conferences and 10 round table

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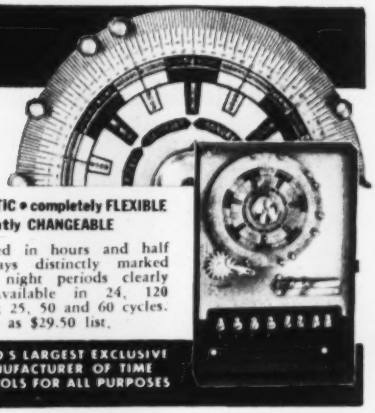

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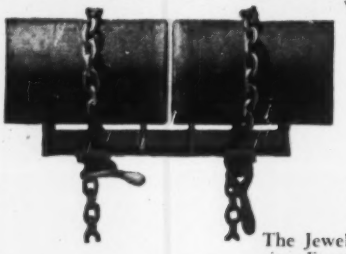

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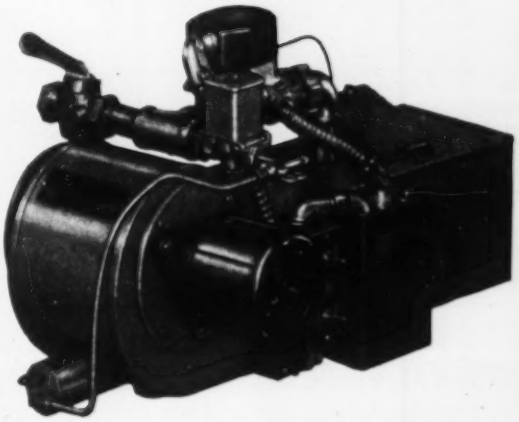

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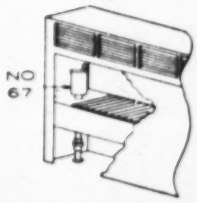

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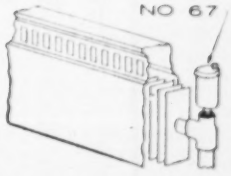

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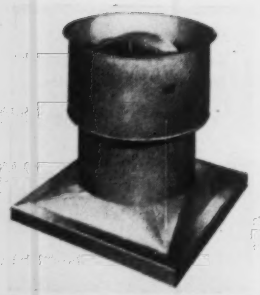

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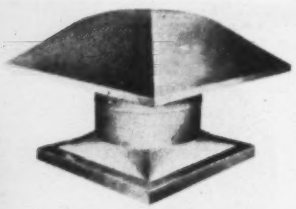

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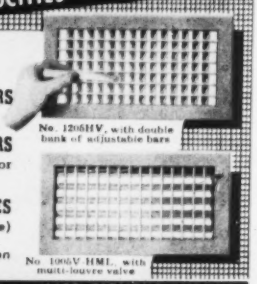

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NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 1061 M & M Bldg., Houston 2—Tenth Annual Conference and Exhibition, March 15-19, 1954. Kansas City, Mo. Co-chairmen are F. L. Whitney, Jr. Monsanto Chemical Co., St. Louis and H. L. Bilhartz, the Atlantic Refining Co., Dallas.

AMERICAN WELDING SOCIETY, 33 W. 39th St., New York 18—1954 National Spring Technical Meeting, May 4-7, Hotel Statler, Buffalo, N.Y. The 1954 Welding and Allied Industry Exposition will be held at the Buffalo Memorial Auditorium, May 5-8.

OIL HEAT INSTITUTE OF AMERICA, INC., 500 Fifth Ave., New York 36—32nd annual convention, May 16-20, to be held concurrently with the 1954 National Indoor Comfort Exposition. Both events will be held at the Commercial Museum, Philadelphia.

HEATING, PIPING AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOC., 1250 Avenue of the Americas, New York 20—65th annual convention, May 21-28, 1954, Hotel Traymore, Atlantic City, N.J.

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for October 1, 1953

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1. The names and addresses of the publisher, editorial director, editor and business manager are:

Publisher, F. P. Keeney, Chicago, Illinois.
Editorial Director, C. M. Burnam, Jr., Chicago, Illinois.
Editor, Robert W. Roose, LaGrange, Illinois.
Business Manager, Chas. E. Price, Glencoe, Illinois.

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Sworn to and subscribed before me this 14th day of September, 1953

Grace E. Waymire

(SEAL) [My commission expires February 10, 1954]

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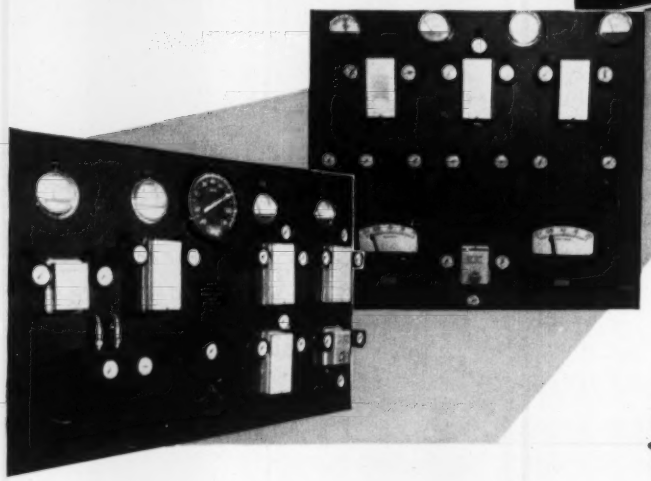

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